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Original Communications

A NEW METHOD OF TREATMENT FOR VAGINITIS AND CERVICITIS

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THE treatment of vaginitis and cervicitis, of bacterial and/or protozoal origin, continues to be of major interest to the gynecologist. While a large proportion of such patients respond with more or less alacrity to the innumerable agents available to the physician today, one often sees cases which are persistently recalcitrant to such treatment and with recurrences which are difficult to avoid because of the many and varied sources of reinfection, as from the urethra, cervix, and the resumption of marital relations.

Trends and Modern Treatment

In recent years a more rationally correct approach to this problem has been induced by a better understanding of the biologic characteristics of the normal vagina, with particular reference to the relationship of vaginal pH and vaginal flora. These relationships have been observed by many investigators,[1-4] and a discussion of these is beyond the scope of this report. From accumulated data, however, one may recognize three grades of bacterial flora at varying hydrogen-ion concentrations: normal—Grade I—homogenous bacteria of Döderlein's bacilli (pH 4.0 to 5.7); abnormal—Grade II—Döderlein's bacilli plus other organisms (pH 4.0 to 6.1); and Grade III—organisms other than Döderlein's bacilli (pH 4.9 to 6.9).

Further, Karnaky[5] has shown that when discharges resulting from acute vaginitis were cultured on nutrient agar adjusted to various pH readings, bacterial growths were most abundant at a pH of 7.6 to 8.0, diminishing as the pH was reduced, with little growth below 5.5, and none at or below 4.5. Vaginal pH variations during the normal life cycle and pH ranges, in which various pathologic organisms are observed, are illustrated in Fig. 1. These observations and similar ones by other authors[1-16] have been responsible for the recent empha-

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51719

sis on the use of jellies, tablets, and powders with bases buffered to pH readings approximating the normal, thereby encouraging the elimination of pathologic organisms and the growth of normal vaginal flora consistent with the healthy vagina.

That the rationale for such bases is good has been demonstrated by a number of investigators who have obtained satisfactory results with plain buffered acid jellies, notably Allen and Baum.[6] Karnaky,[5] Bland and Rakoff,[7] Chrisman,[8] and Roblee.[9]

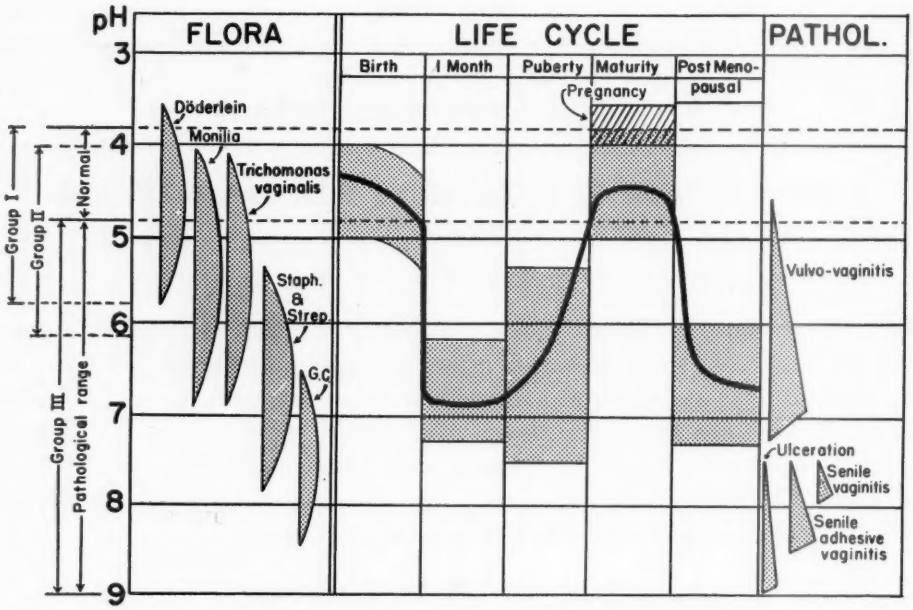


Fig. 1.—Vaginal pH variations during the normal life cycle and pH ranges in which various organisms and vaginal pathology are observed. (Modified from Siegler: Fertility in Women, J. B. Lippincott Co., Philadelphia.)

The emphasis on correctly buffered bases in the treatment of vaginitis and cervicitis has not diminished the desirability of incorporating antiseptic agents into the buffered base. Elden,[10] Karnaky,[11] and Owen[12] employed diodoquin with a buffered lactose powder or tablet base; Brougher[13] used Caprokol in a jelly base; Meigs[14] used acetarsone medicated tampons; Parks[15] and Angelucci [16] used an acid sulfanilamide ointment, and Roblee[9] and Findley[17] used sulfathiazole and sulfanilamide in an acid jelly. They all obtained satisfactory results.

Roblee[9] favored the use of sulfathiazole with his acid jelly, although recognizing that the buffered acid jelly alone was effective in trichomonas vaginitis therapy. Discussing his results, he states, "In our hands the addition of sulfa drugs to the pH factor has been as great an improvement as the pH factor was over older methods of antiseptics used ten years ago in the management of cervicitis and vaginitis." He observed particularly noteworthy results in accelerating the restoration of Type I smear from Type III smear by sulfathiazole and acid jelly, although restoration from Type II smear resulted just as easily from acid jelly alone. He observed excellent results in the control of in-

fections after conization of the infected cervix in cases of acute gonorrhea wherein positive cultures persisted after oral sulfathiazole therapy. Findley[17] likewise obtained gratifying results in the cauterized cervix with sulfanilamide in a buffered acid jelly.

Desirable Characteristics in the Ideal Anti-Vaginitis-Cervicitis Agents

The author has run the gamut of medicaments for the control of infections in vaginitis and cervicitis from the insufflation of silver picrate, the insertion of medicated suppositories and tampons, capsules of ozonide of olive oil, tablets of beta lactose and sulfonamides, and finally the newer type of acid buffered jellies. A critical evaluation of all these medicaments has led him to conclude that the ideal antiinfective agent should be:

1. As easy as possible to apply by the physician in his office and by the patient at home, because treatment sometimes must be continued by the patient over many days or weeks. Successful results due to patient cooperation can only be expected, if it can be done with the least possible inconvenience.
2. Buffered effectively so as to promote the reestablishment of the physiologically correct acidity and growth of Döderlein's bacilli consistent with a healthy vagina.
3. Antibacterial so as to control rapidly persistent infections especially in cervicitis requiring electrosurgery.
4. Of such a physical consistency as to assure intimate and prolonged contact with vaginal and cervical mucosa. Present-day water-dispersible jellies have been an improvement over powders and tablets. However, the ideal base should dissolve in and should approach in physical characteristics (adhesiveness, consistency, wetting power) the vaginocervical secretions.
5. Nonirritating and nontoxic, even when used over a period of time.
6. Because of the above properties, it should give satisfactory results when used as the single agent of choice in bacterial and protozoal vaginitis and cervicitis of all types.

A Sulfathiazole Acid Jelly With a New Base

The author believes that the above desirable conditions are most closely approached by an acid jelly, containing sulfathiazole in actual solution, of the following composition:

10.0 per cent sulfathiazole*
3.0 per cent lactic acid
1.0 per cent acetic acid
0.1 per cent sodium tetradecyl sulfate
85.9 per cent polyethylene glycol

The acid jelly base, polyethylene glycol, has all the desired characteristics for vaginal medication. It is nonirritant and nontoxic, has excellent wetting properties, and maintains its jelly consistency at body temperature. It dissolves completely in the vaginal secretions, and possesses the unique property of dissolving large quantities of sulfathiazole which, in turn, become soluble in the

*Westhiazole Vaginal, Westwood Pharmacal Corp., Buffalo, New York.

secretions. This last property makes this jelly far more sulfa active than it is possible to obtain with the usual suspensions of sulfathiazole.[18] The jelly is sterile and can therefore be used in packs and tampons post surgically. The pH approximates 4.0, the buffering power is large, and there is no excessive leakage from the vagina unless the discharge is copious.

The method of intravaginal administration of jellies, using a collapsible tin tube and lucite applicator, although preferable to older methods, still entails the unnecessary fuss and bother coincident with the transfer of jelly from tube to applicator to vagina and the washing of the applicator by the patient or sterilizing of his applicator by the physician. At the author's suggestion, a single-dose, disposable paper applicator was conceived for use with this sulfathiazole acid jelly. Fig. 2 is a sketch of this paper applicator which is filled with one-fourth ounce of the jelly—sufficient to deliver between five and six cubic centimeters. Its use by patient and physician is convenient and time saving.

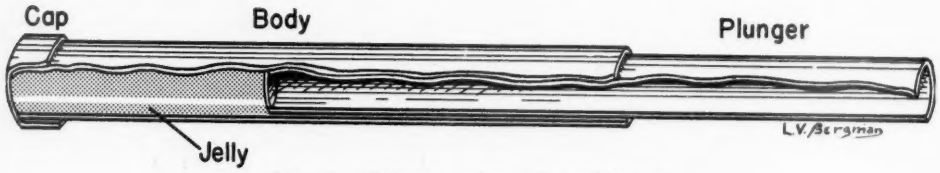


Fig. 2.—Cutaway view of applicator.

Investigational Data

This report covers a study of the effectiveness of the above-described sulfathiazole acid jelly in the treatment of vaginitis and as an adjunct in the treatment of cervicitis as compared to (1) this same acid jelly base alone, (2) the acid base with 1 per cent iodine, (3) the acid base with 1 per cent gentian violet, (4) beta lactose and sulfathiazole tablets.

The sources of patient material—230 cases of vaginitis and 152 cases of cervicitis, used in this study—were from the author's own private practice and the gynecologic clinics of Unity Hospital and Brooklyn Women's Hospital. In addition to the usual routine records on each patient, the following observations were made on each vaginitis case before, at various times during the treatment, and at the termination of treatment:

1. Urine culture, in catheterized specimens whenever urinary symptoms were present.
2. pH readings with a Beckman meter, using glass electrodes in the vagina and cervix (Figs. 3 and 4).
3. Wet smear and Gram stain—cultures whenever necessary. Similarly complete observations were recorded for each cervicitis case.

Applications of the jellies or tablets were made once or twice daily—one application preferably made at night, before retiring. The use of douches was not permitted. In cervicitis cases treated electrosurgically, these applications were made postoperatively and in a few cases during the waiting necessitated by the proximity of the menses.

The criteria for cure were: complete relief from symptoms, return to normal pH, and negative smears taken at intervals during the three months following termination of treatment. These intervals were: at time of menses, immediately after menses, and at the midperiod.

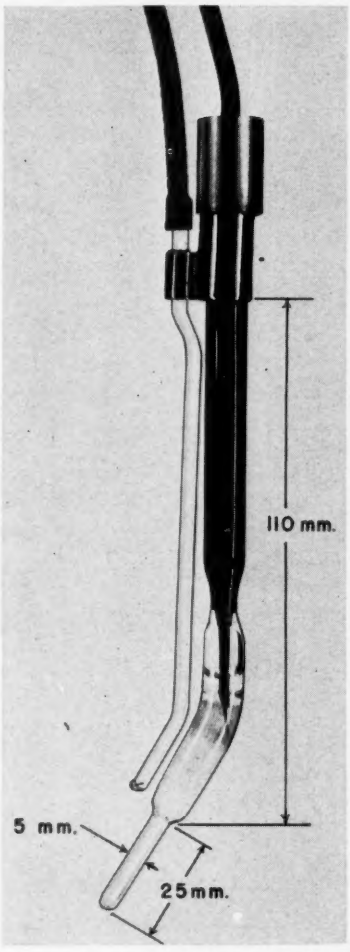


Fig. 3.—Photo-diagram of special cervical and vaginal combination electrode, obtainable from Arthur H. Thomas and Co., Philadelphia, Pa.

Patients in whom symptoms and laboratory findings indicated more or less complete relief, but who had recurrences before these criteria for cure were completely fulfilled, were designated as improved. Patients who discontinued treatment at any time during the course are excluded from this report.

Response of the cervicitis cases to treatment was judged by the character and duration of the discharge, the type of vaginal and cervical smears (or cultures), and the healing time of the lesions to complete epitheliazation.

Results

Vaginitis Cases.—Table I summarizes the results following the use of the sulfathiazole-polyethylene glycol acid jelly. About 83 per cent of the cases were considered cured. Ten per cent were considered improved but not cured,

and in 8 per cent, the treatment was ineffective. In the four cases of gonorrheal vaginitis, reported as cured, sulfathiazole was also administered orally. Response to treatment was excellent whether the vaginitis was trichomonal, monilial, or nonspecific in origin.

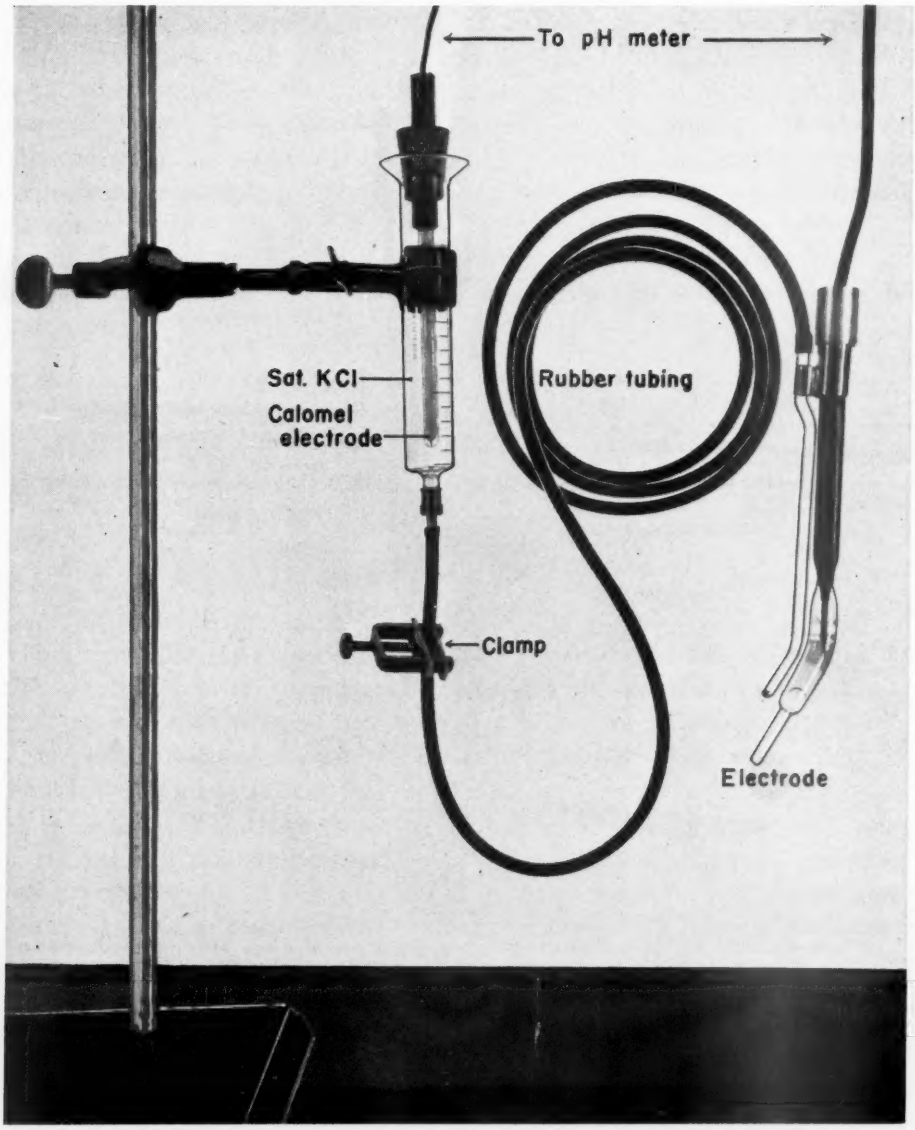


Fig. 4.—Photo-diagram of cervical-vaginal electrode connections. Upper leads go to Beckman pH meter. Pinch clamp permits easy removal of electrode for cleaning. Calomel electrode is suspended in saturated KCl solution in convenient 20 c.c. syringe barrel.

Of the 18 failures, 16 were trichomonas and two monilia. In six of these cases the husband was found to be the cause of continuous reinfection; in two, symptoms were controlled as long as the husband used a condom during coitus.

Duration of treatment before symptoms cleared completely varied from one to seventeen weeks and averaged five and one-half weeks. In most cases

TABLE I. DATA SUMMARY ON 230 VAGINITIS CASES

AGE INCIDENCE		PAROUS STATE		VAGINAL DISCHARGE				VAGINAL SYMPTOMS		VAGINAL EXAMINATION	
CASES	YEARS	PARA	CASES	SYMPTOMS	CASES +	CASES ++	CASES +++	SYMPTOMS	CASES	FINDINGS	CASES
10-20	22	Nulli	94	Amount	30	140	60	Vulvitis	208	Congestion	198
20-30	90	Primi	62	Odor	128	42	6	Irritations		Mucosal petechiae	104
30-40	90	Multi	74	Itch	136	52	14	Vaginal	186	Skene's and Bartholin's	8
40-50	16	Pregnant	22	Bladder symptoms			134	Perirectal	36	Cervicitis	60
50-60	12			Backache			68	Dyspareunia	156	Sacrouterine ligaments tender	46

TYPES OF INFECTION INCIDENCE		NUMERICAL COMPARISON OF RESULTS		DURATION OF TREATMENT BEFORE SYMPTOMS CLEARED	
INFECTION	CASES		CASES	WEEKS	CASES
Trichomonas	142	Cured	190	1- 2	26
Monilia	42	Trichomonas	110	2- 4	48
Monilia and trichomonas	2	Monilia	36	4- 6	42
Mixed (staph. and strep.)	40	Gonococcus	4	6-10	48
Gonococcus	4	Mixed	40	10-15	30
		Improved	22	Over 15	18
		Trichomonas	18		
		Monilia	4		
		Not improved	18		
		Trichomonas	16		
		Monilia	2		

prompt deodorization of the discharge and elimination of itching were obtained. A change in type of smear toward the normal Type I and a lowering in pH to the optimal 4.0 to 5.0 were observed in the improved or cured cases. A mild but definite astringent effect was noted by the patients using the jelly.

Treatment was discontinued in two cases on development of a mild, transient rash and an attack of hives which may have been attributed to sulfathiazole sensitivity. However, repeated determinations of the sulfathiazole level in the blood failed to reveal a demonstrable absorption in any patient.

Twenty-four cases of trichomonas were treated with the polyethylene glycol acid jelly base, with good results in 75 per cent of the cases. The six cases (25 per cent) which failed to respond were subsequently cured on changing to the sulfathiazole jelly.

Twenty-eight cases of monilia responded as satisfactorily with the gentian violet polyethylene glycol acid jelly as with the sulfathiazole jelly. However, the two monilia cases in which the sulfathiazole jelly failed also did not respond to subsequent treatment with the gentian violet jelly.

Results were good in six cases of trichomonas treated with 1 per cent iodine in the acid jelly base. However, a chemical burn was produced in two cases, and use of this jelly was therefore discontinued.

Tablets of beta lactose and sulfathiazole were used in ten cases of trichomonas resulting in eight (80 per cent) cures and two (20 per cent) failures

TABLE II. VAGINAL SMEARS AND VAGINAL pH BEFORE AND AFTER TREATMENT—VAGINITIS CASES

TYPE OF SMEAR			VAGINAL pH		
	BEFORE	AFTER		BEFORE	AFTER
TYPE	CASES	CASES	pH	CASES	CASES
Trichomonas Cases:					
I	0	89	4.0-5.0	71	130
II	40	41	5.5-6.0	32	6
III	102	12	6.5-7.5	39	6
Monilia Cases:					
I	0	36	4.0-5.0	26	39
II	16	6	5.5-6.0	16	3
III	28	2	6.5-7.5	2	2
Mixed and Gonococcus Cases:					
I	0	23	4.0-5.0	9	41
II	10	21	5.5-6.0	24	3
III	34	0	6.5-7.5	11	0

TABLE III. DATA SUMMARY ON 152 CERVICITIS CASES

AGE INCIDENCE		PAROUS STATE		MENSTRUAL AND OTHER HISTORY		PREOPERATIVE DISCHARGE	
YEARS	CASES	PARA	CASES	HISTORY	CASES	DISCHARGE	CASES
10-20	2	Nulli	34	Regular	100	Viscid	30
20-30	58	Primi	52	Irregular	32	Mucoid	120
30-40	64	Multi	66	Menopause	20	Purulent	116
40-50	18	Sterile	10	Dysmenorrhea	22	Bleeding	44
50-60	8			Backache	6		
Over 60	2			Uterine fibromyoma	4		
				Postvaginal plastic surgery	6		
				Prolapsed uterus	4		

PREOPERATIVE SMEAR AND/OR CULTURE		PREOPERATIVE CERVICAL LESION		CERVICAL TREATMENT		POSTOPERATIVE BLEEDING INCIDENCE	
BACTERIOLOGY	CASES	CERVICAL LESION	CASES	TREATMENT	CASES	TYPE	CASES
Staphylococcus	4	Cervicitis (acute)	10	Nasal tip cautery	26	Spotting	44
Mixed	102	Chronic cervicitis	82	Conization	46	Mild hemorrhage	
Gonococcus	6	Erosions—papillary with cystic changes	36	Coagulation	44	Primary	4
Negative	40	Lacerations with cystic changes	32	None	34	Secondary	2
Trichomonas	6	Gonococcal cervicitis	6				

which subsequently were cured with the sulfathiazole jelly. This tablet treatment also failed in two nonspecific cases which later cleared with acid polyethylene glycol.

Cervicitis Cases.—Table III summarizes the results obtained with the use of the sulfathiazole-polyethylene glycol acid jelly either alone or as an adjunct to electrosurgical cervical treatment.

Nasal-tip cautery was used in 26 cases, conization in 48, coagulation in 44, and no cervical surgery in thirty-four. In all cases the following noteworthy postoperative observations were evident:

1. Absence of foul odor.

2. Absence of profuse discharge; during the sloughing period only slight amounts of thin, watery discharge were observed. This usually disappeared following separation of the slough.

3. Good control of bleeding—only spotting occurred in 44 cases, and slight hemorrhage in six. These occurred at the time of separation of the slough, usually at about the twelfth to fourteenth day. No subsequent surgery was necessary for their control.

4. A mild stenosis was noted in six cases, but pyometra and infection were absent.

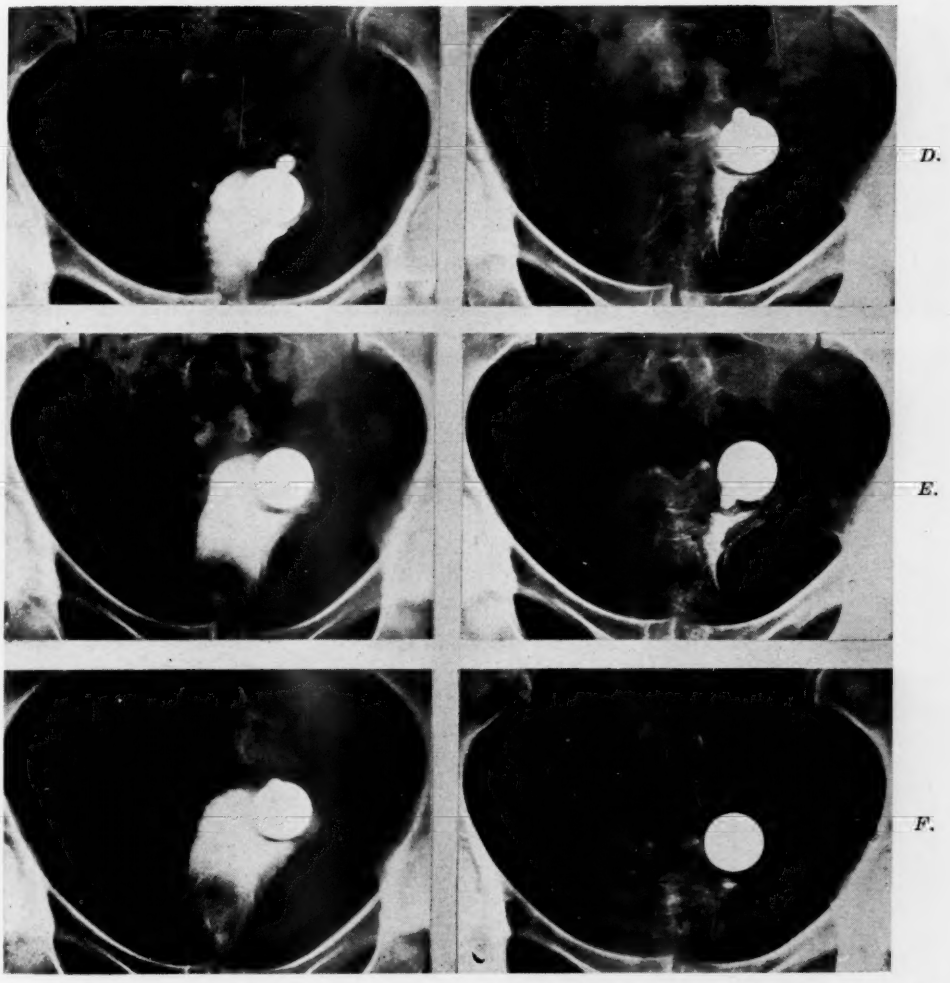


Fig. 5.—Pessary in cervical os and after instillation of 5 c.c. of sulfathiazole jelly plus barium sulfate. (a) Immediately after instillation; after walking and normal activity; (b) one-half hour later; (c) one and one-half hours later; (d) four hours later; (e) eight hours later; (f) twenty-four hours later.

5. In all cases the vaginal pH was between 4.0 and 5.0 at the end of treatment. At this time also the vaginal smear was Type I in 82 per cent of the cases and Type II in the remaining 18 per cent. About 50 per cent of the cases had a cervical pH of between 6.0 and 7.5 before treatment. After treatment this was between pH 8.0 and 8.5 in 92 per cent.

6. A marked reduction in healing time. In 80 per cent of the cases slough removal occurred within two weeks and healing to full epithelization was complete within five weeks in 90 per cent of the cases. This compared favorably

Plate I

Row A.

Left—Sulfathiazole acid jelly on the cervix, two hours after application.
Center—Cervicitis. Note jelly on cervix twelve hours after application.
Right—Same patient, six weeks later. Daily applications of sulfathiazole acid jelly. No other therapy. Cured.

Row B.

Left—Six hours after application of sulfathiazole acid jelly to cervix; Trichomonas infection.
Center—Cervicitis, two weeks postconization. Note jelly on cervix.
Right—Same patient, healed after five weeks. Daily applications of sulfathiazole acid jelly.

Row C.

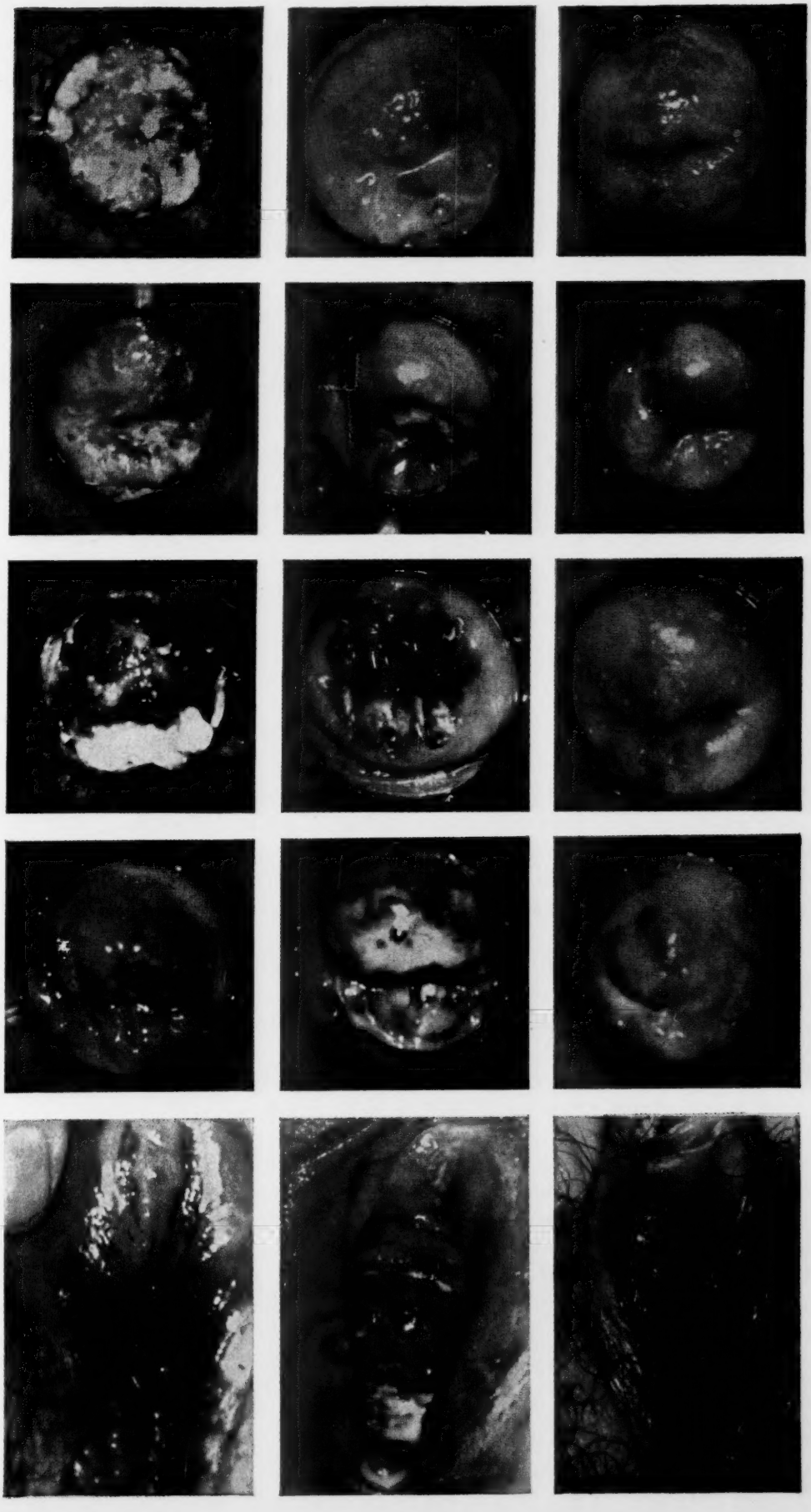
Left—Monilia infection, gravid cervix.
Center—Cervicitis, two weeks postnasal tip cautery.
Right—Same patient, healed after four weeks. Daily applications of sulfathiazole acid jelly.

Row D.

Left—Ulcerative cervicitis.
Center—One week postcoagulation.
Right—Same patient, five weeks later. Note sulfathiazole jelly on cervix and with complete epithelization.

Row E.

Left—Severe vaginitis of Trichomonas origin.
Center—Vaginitis, Monilia.
Right—Vaginitis, with application of ¼ per cent gentian violet acid jelly.



with Findley's[17] average of seven and one-half weeks without medication and is similar to the results reported by Roblee[9] when using sulfathiazole acid jelly.

TABLE IV. DATA SUMMARY ON CERVICITIS CASES

HEALING TIME			VAGINAL SMEAR TYPE			VAGINAL pH			CERVICAL pH		
WEEKS	SLOUGH CASES	EPITHELIZATION CASES	TYPE	BEFORE CASES	AFTER CASES	pH	BEFORE CASES	AFTER CASES	pH	BEFORE CASES	AFTER CASES
1	22		I	22	124	4.0-5.0	92	152	6.0-6.5	24	4
2	82		II	84	28	5.5-6.0	54		7.0-7.5	50	8
3	4		III	46	0	6.5-7.0	6		8.0-8.5	78	140
4	6	84									
5		52									
6		6									
7	2	6									
+7		4									

The 34 cases wherein the sulfathiazole jelly alone was used also responded gratifyingly well. Healing of the cervical lesions and disappearance of symptoms made superfluous further cervical treatment.

The acid polyethylene jelly base was used in 32 cases with results similar to those obtained with the sulfathiazole jelly, but the infections were not as easily controlled, and healing time was definitely longer. In ten of these cases it was necessary to change to the sulfathiazole jelly to accelerate healing.

Other Uses

The sulfathiazole-polyethylene glycol acid jelly was also found to control vaginal infections when used after plastic repairs, vaginal hysterectomies, and other vaginal surgery. Here the jelly was impregnated into the usual postoperative pack. When this was removed, one or two daily applications of the jelly were continued until complete healing occurred. Excellent control of postoperative discharge, odor, bleeding, and other symptoms was obtained, as with the cervicitis cases.

Use of the jelly in the cupped end of the Gellhorn pessary, before its insertion for control of prolapsed uterus, was also found to alleviate the odor and discharge usually accompanying such use of the pessary.

Discussion

An acid polyethylene glycol base, such as used in this study, seems to be the ideal base for intravaginal medication available today. While this base alone is an effective antivaginitis medication, the dissolution of 10 per cent sulfathiazole in it seems to enhance its value in these conditions, probably because of its superior action against secondary bacterial infections. This jelly, because of its adhesiveness, its semiliquid consistency (at body temperature), and its wetting power, assures maximum contact of the medication with vaginal and cervical mucosa. This is indicated by the x-ray reproductions presented in the figures and in the color photographs, Plate I. The appearance of the cervix in some infectious conditions is also illustrated in Plate I.

The sulfathiazole-glycol acid jelly can be used with safety over prolonged periods of treatment, although the possibility of sulfa sensitivity should not be overlooked. In contrast, the insufflation of powders, especially during pregnancies, is a dangerous procedure and can cause fatal accidents, as have been reported recently by Breyfogle,[19] Pierce,[20] Brown,[21] and Partridge.[22]

The well-known observation that the rate of healing of wounds is markedly prolonged by infections has been experimentally confirmed by Howes,[23] who has shown that epithelization is inhibited completely in the presence of infection. In a large proportion of cervical cases treated electrosurgically, pathologic organisms are present in abundance. It is not surprising, therefore, that these surgical lesions heal slowly and with annoying symptoms.

Patient cooperation in maintaining daily, and sometimes necessarily prolonged treatment is more easily obtained with the single-dose, disposable paper applicator than with the usual tin tube and lucite applicator.

Summary

1. A new antivaginitis sulfathiazole polyethylene glycol acid jelly is described.

2. The jelly is nonirritating, nonstaining, and of agreeable odor. It spreads over the cervical and vaginal surfaces and is completely soluble in the secretions. It does not easily leak out of the vagina unless the discharge is profuse. It has a mild but definite astringent effect on the vaginal mucosa.

3. Use of the jelly has resulted in excellent control of vaginitis of trichomonal, monilial, gonococcal, and nonspecific origin in 93 per cent of the cases studied, and in permanent cure in 83 per cent.

4. Use of the jelly alone has given good results in the management of cervical infections in 22 per cent of the cases treated.

5. The period of convalescence can be markedly shortened, and annoying symptoms reduced by using the jelly before and after such procedures as conization, coagulation, cautery, plastic repairs, and other intravaginal surgery. Healing was complete within an average time of five weeks with a minimum of sequelae.

6. The convenience and simplicity of the single-dose disposable paper applicator facilitates intravaginal medication in the office and in the patient's home. This appears to fulfill the therapeutic objective as set forth by the Council on Pharmacy and Chemistry of the American Medical Association[24] in its discussion of antitrichomonas agents, "thoroughness and persistence with the simplest and least messy procedures. . . ."

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706 EASTERN PARKWAY

A TEST FOR DETERMINING THE TIME OF OVULATION AND CONCEPTION IN WOMEN*

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MANY methods have been tried for determining the time of ovulation in women. Hartman[1] and Dickinson[2] have reviewed the literature. Allen, Pratt, Newall, and Bland[3] recovered human ova by washing the oviducts on the fourteenth, fifteenth, and sixteenth days. They concluded that, if the ovum requires seventy-two to ninety-six hours for its transport through the oviduct, ovulation takes place presumably between the twelfth and fourteenth days.

Rock and Hertig[4] removed uteri containing very early embryos at known times of the cycle, and estimated that ovulation occurs from days 13.5 to 19.5 of the cycle. Schroeder,[5] Shaw,[6] Frankel,[7] Ogino,[8] and Meyer[9] reported ovulation to have happened on days 13 to 19, as indicated by macroscopic and microscopic study of the ovary. Dickinson,[10] by manual examination of selected women under specially favorable circumstances, detected changes in the ovary at the time of ovulation.

Papanicolaou,[11] and de Allende, Shorr and Hartman[12] have studied the changes in the vaginal smear in relation to ovulation. Wollner[13] described physical changes in the cervix at that time. Long before ovulation the cervical canal was dry. At ovulation it exhibited a thick, glairy, mucous discharge. Siegler,[14] from endometrial biopsy studies, concluded that menstruation occurs at a period of from twelve to sixteen days after ovulation.

Knaus[15] observed that posterior pituitary extract (pituitrin) had no effect on the myometrium during the period that the corpus luteum was active. He assumed that ovulation takes place two to three days before the uterus becomes refractory to the drug, and concluded that ovulation occurs exactly fifteen days before the ensuing menstruation. Ogino[8] confirmed this statement by observing signs of recent ovulation at laparotomy.

D'Amour[16] assayed urine daily for both estrogen and gonadotrophin, and described a gonadotropic peak at the time of ovulation.

Alteration in body temperature during the menstrual cycle, in relation to ovulation and pregnancy, has been the subject of investigation for many years. The temperature of a healthy individual is theoretically 98.6° F. There are slight variations from this figure at about ovulation time. It has been found that a woman's temperature is lower during the first part of the menstrual cycle; at about ovulation time there is a slight dip, followed by a two-fifths to four-fifths of a degree increase in temperature. The temperature then remains at this higher level until the ensuing menstruation.

Zuck,[17] Rubinstein,[18] Tompkins,[19] and others tested the temperature changes at ovulation by means of so-called "timed" conceptions. Couples who were planning a pregnancy agreed to use a selected time for coitus on the basis of

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the temperature shift. Greulich, Morris, and Black[20] correlated the temperature shift at midperiod with ovulation. Several days after the temperature rise, ovulation was confirmed by laparotomy.

Burr, Hill, and Allen[21] described an electrometric technique for registering the time of ovulation.

Mittelschmerz, intermenstrual spotting, and other signs are recognized as indications that ovulation is taking place. Wharton,[22] on the basis of these signs, places ovulation between days 9 and 16 after the onset of menstruation, and Siegler,[14] between days 10 and 18 in patients whose cycles vary between 24 and 33 days. Farris[23] measured the walking activity of twelve healthy women for one to six months. All of these individuals experienced an increase in activity at the midperiod.

Dickinson[2] reported conception occurring from isolated coitus at all times of the cycle. Seymour[24] reported successful impregnations on days 2, 4, and 5 in 28-day cycles, and Guttmacher,[25] Cary,[26] and Siegler,[14] in the practice of isolated artificial insemination, recorded conceptions from days 8 through 19 in cycles of 26 to 30 days.

D'Amour,[27] in comparing methods used in determining the time of ovulation, concluded that: (a) subjective experiences are valueless as tests for ovulation; (b) body temperature fluctuations are not sufficiently regular or clear-cut to be reliable; (c) the uniformity of the results of hormonal assays and vaginal smears confirms the validity of each, in that a certain sequency of events appears typical of the normal cycle; (d) because of its sharpness and its apparently close association with ovulation, the gonadotrophin peak occurring in the midinterval is considered as most indicative of the exact time of ovulation.

The various methods now in use for determining the time of ovulation have certain obvious disadvantages. Some of them, such as laparotomy, have only academic interest. Others, such as change in body temperature and subjective feelings, lack value due to the fact that too much is left to the patients, and because many of them fail to conceive when the so-called ovulation time has been determined. Endometrial biopsies and hormonal assays measure ovulation after the event has occurred. None of the above methods are either very accurate or very practical.

The test to be described supplies a new approach to the problem of determining ovulation time. It is a purely objective method.

Materials and Methods

In brief, the occurrence of ovulation is detected by the reaction of the ovary of the immature white rat to the urine of the patient. If ovulation is not taking place, the patient's urine has no effect upon the ovary of the rat; if it is taking place, the rat's ovaries become hyperemic.

The details of the test are as follows: Urine passed on arising in the morning is employed. The test animal is an immature Wistar rat between 22 and 25 days of age, and weighing between 30 and 50 grams. Two cubic centimeters of the urine are injected subcutaneously into each of two animals. At the end of two hours the rats are killed by illuminating gas. Their abdomens are opened immediately. Each ovary is inspected and its degree of redness is compared with the colors of the Munsell color chart.

The course of the test is determined in two different months for each individual. The first test is made to determine whether it takes place, and, if so,

the day when the reaction begins, and whether it is entirely normal. The test made the following month, if normal, permits an accurate estimate of the optimum time to perform coitus. During the testing periods of both months coitus is interdicted, because it produces a hyperemia in the rat ovary (Farris[28]).

The day for starting the test depends upon the length and the regularity of the patient's cycles. The testing period covers the five or six days preceding the anticipated date of ovulation, the ovulation period, and three days following it.

It has been found that urine can be kept in a household refrigerator without any preservative for as long as five to six weeks, without any apparent loss in the urine's power to produce a color reaction upon testing. Specimens can be shipped from a distance packed around a container of ice or be frozen solid with dry ice, without losing their potency.

A Munsell color chart provides a graduated color scale in red, for measuring the color of the rat's ovary after injection of the rat with the patient's urine. The 5.0 R Munsell chart contains all of the necessary shades of color required for the test. These standard colors represent equally spaced divisions of the three attributes of color known in the Munsell system of color notation as hue, value, and chroma. The hue of a color indicates its relation to red, yellow, green, blue, and purple; the value, its lightness; and chroma, its strength (or departure from neutral). In recording a color by the Munsell notation system, the symbol for hue is written first, and is followed by a symbol written in fraction form, the enumerator indicating the value, and the denominator indicating the chroma (H V/C). For example, a sample which is 5 red in hue, 5 in value, and 8 in chroma is written 5.0 R 5/8.

The color scale shown in Table I facilitates the classifying of the degrees of hyperemia observed in the rat ovary.

TABLE I

HYPEREMIA OF THE RAT OVARY		CORRESPONDING COLOR IN 5.0 R MUNSELL COLOR CHART
None	0	5.8/2-5.6/4
Doubtful	D	5.6/6
Present	1+	5.6/8-5.6/10
Present	2+	5.5/8
Present	3+	5.5/10
Present	4+	5.5/12

Degrees of hyperemia which may be present in the ovary of the rat following the injection of the animal with the patient's urine, and its grading according to the standards of the Munsell Color Chart.

It is important to match the colors under standardized lighting conditions. For this purpose a hood is employed which is painted a neutral gray. A Macbeth Daylight light, Model ADP 20, is suspended 18 inches above the animal board. This light was found to be superior to other artificial lights, and to daylight.

Each ovary is graded as to its degree of hyperemia. The ovary is lifted from the abdomen and is placed on a piece of neutral gray paper one-fourth inch square. When comparing the ovary with the color chart, the colors on the chart that are not being used are masked with a piece of neutral gray paper.

Two rats are used for each specimen of urine to be tested, thus supplying four ovaries for evaluation.

The reaction exhibited by one animal is expressed in terms of the degrees of hyperemia observed in both of its ovaries. Since they do not necessarily exhibit the same degrees of hyperemia, this fact complicates somewhat the classification of the reaction of a given animal. The possible degrees of hyperemia which may occur in the ovaries are presented in Table II. The reaction of an

TABLE II. REACTION OF RAT OVARIES TO HUMAN URINE

HYPEREMIA OF OVARIES		
REACTION, RIGHT	REACTION, LEFT	CLASSIFICATION
Negative	Negative	0
Negative	Faint	0
Faint	Faint	D
Negative	Definite 1	+
Definite 1-4	Definite 1-4	+

0 = Negative, or no hyperemia
D = Doubtful, or faint hyperemia
+ = Positive or hyperemia in 4 degrees

Method of evaluating the hyperemia of the rat's ovaries following administration of the patient's urine.

animal is classified as negative (0) if both ovaries exhibit no hyperemia, or if one ovary shows only a faint degree of hyperemia. If both exhibit a faint degree of hyperemia, the reaction is classified as doubtful (D). The reaction is said to be positive (+) if one ovary alone or both ovaries show a definite hyperemia. The positive reactions are listed in four degrees (1+) (2+) (3+) (4+), according to the amount of hyperemia. The reactions are judged by two individuals, and it is seldom that there is any marked disagreement between them.

Results

Observations were made upon 100 women. Of these, 12 were unmarried and 88 were married. Of the latter, 76 wished to become pregnant. Fifty of the latter had been inseminated artificially for periods varying from a few months to several years, with no conceptions resulting.

Types of Reactions.—

The reactions are classified as either normal or abnormal. In the case of a normal reaction there is a definite deepening of the color of the rat ovary for three or four consecutive days near the middle of the menstrual period.

Normal Reactions.—

The majority of patients show a normal color reaction month after month. Table III records some of the normal reactions which occurred in 41 subjects. It should be noted that the reactions occurred earlier in the shorter cycles than in the longer ones. For example, in subject L. B. C., with a 21-day cycle, hyperemia appeared on the sixth, seventh, and eighth days. In the case of individual A. F. A., with a cycle of 33 days, hyperemia was not present until days 15, 16, 17, and 18.

Thirty-five women supplied normal reactions during their control tests. Nineteen of them (Table III) had reactions which lasted for three days, and 16 had reactions which lasted for four days.

Pregnancy.—

A number of patients experiencing normal reactions became pregnant. None experiencing abnormal reactions did so. Ten became pregnant when coitus took place on the third or fourth day of consecutive color reaction. No conceptions occurred when intercourse was delayed until the color reaction had disappeared.

TABLE III. NORMAL REACTIONS*

SUBJECTS	LENGTH OF CYCLE (DAYS)	DAY OF MENSTRUAL CYCLE																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
L. B. C.	21					0	+	+	+	0	0												
R. S. S.	21								+	+	0	0	0	0									
R. C. W.	22			0	0	0	0	+	+	+	+												
L. A. F.	22											+	+	+	+	0							
J. E. C.	23						+	+	+	0	0	0	0	0	0								
R. C. W.	24				+	0	+	+	+	0	+	0	0	0	0	0	0	0					
M. G.	24						+	+	+	0	+	0	0	0	D	0	0	+	D				
W. F. L.	24						0	+															
E. G. M.	24												0	D	+	+	+	0	0				
A. D.	25							0	+	+	+	0	0	0	0								
M. M.	25									+	+	0	0	0	0	0	0	0	0	0			
M. G. S.	25								0	+	+	D	+										
W. H. H.	25										+	+											
J. K.	25									D	+	+											
J. K.	25									0	0	+											
L. S. K.	25											+	+	+	+	0	0	0					
I. S.	25										0	+	+	+	0	0							
R. D.	25											0	D	+	+	+	0	D	+				
C. M.	25									0	0	0	0	+	+								
L. S. W.	25												0	0	+	+	+	0	0				
L. W.	25												0	0	+	+	+	0	0				
L. K.	26							0	+	+	+	+	0										
J. K.	26							0	+														
M. P.	26										+	+	+	+	0	0		0	0				
M. T.	26										+	+	+	+	0	0							
J. K.	26								0	0	+												
N. M.	26							0	0	0	0	0	0	+	+	+	0	0	0				

TABLE III—CONT'D

W. F. L.	27										+	+	+												
D. C.	27										0	+	+	+	0	0									
R. B. R.	28											+	+	+	0	+									
W. K.	28												0	+	+			0							
M. B. S.	28										0	0	0	+	+	+	0	0							
M. M. S.	28													D	+	D	+	+	0	0	+	0	0	0	
N. M.	28												0	0	+	+	+	+	0	0	0				
M. S.	28											0	0	0	+	+	+	+	0						
W. F. L.	28											0	0	0	0	+	+								
W. A.	29												0	+	+	+	D	0	0						
L. R. B.	29												0	0	+										
R. DeF.	29											0	0	0	0	+	+	+	0	+	0				
J. E.	29										0	0	0	0	0	0	0	+	+	+	0	0	0	0	
V. C. W.	30										+	+	+	+	0	0	0	0							
V. C. W.	30						0	0	0	0	+	+	+	+	+										
M. S. T.	30				0	0	0	0	0	0	0	0	0	0	0	+									
L. R. B.	30													0	0	+									
D. K.	30															0	0	+							
E. G.	31												0	+	+	+	+	0							
E. Y.	31														0	0	+	+	+	0	0	0	0		
I. W.	32												0	+	0	+	+	+	0	0	+	0			
J. V.	32													0	0	0	+	+	+	0					
M. S. T.	32											0	0	0	0	0	0	0	+	D					
L. R. B.	33													0	0	0	+								
A. F. A.	33												0	0	+	0	+	+	+	+	0	0			

52 cycles; 41 different subjects.
+ = Positive color; 0 = no color; D = doubtful reaction.

*Normal reactions which occur in the rat's ovaries following the injection of the animal with the patient's urine. The observations are listed according to the length of the menstrual cycle of each subject. Note that the reactions occur earlier in the shorter cycles than in the longer cycles.

Patients with normal reactions became pregnant when coitus was planned in relation to the ovulation reaction.

Of 50 patients who were being inseminated artificially at frequent intervals without success, only 11 showed any normal reactions. Eight of these 11 women conceived after the insemination date was chosen according to this test.

Abnormal Reactions.—

There are four types of abnormal reactions, as shown in Table IV:

1. No color
2. One day only of color
3. Two days only of color
4. Split reaction—one or two days of color, separated by no color for one, two, or more days.

This table records the abnormal reactions of 34 subjects. The 12 patients in Group I were probably anovulatory. With one exception, none of the women who exhibited color reactions of only two days' duration has as yet become pregnant. In this case, coitus took place on the second day of color, which was the last day of color of this patient.

Individuals who had been sterile for a long time exhibited a high incidence of abnormal reactions, but occasionally had normal ones. For example, one patient with regular 25-day cycles showed a normal reaction, and ovulation presumably occurred on day 16. The second following cycle was abnormal. The third and fourth cycles showed abnormal 2-day color reactions on days 10 and 11. The fifth cycle was normal with three days of color, and ovulation presumably occurred on day 11.

The length of the menstrual cycle and the first day of color reaction are plotted in Fig. 1, so that ovulation time may be determined in a relatively simple manner. The coordinates of the points are based on: (1) the length of the menstrual cycle (X) in forty women who demonstrated the usual three or four days of color reaction during time of ovulation, and (2) the first day of color reaction (Y) in these women. The scatter of the points seems to indicate that the length of the cycle and the first day of color reaction are directly associated, i.e., as the length of the cycle increases, the first day of color is later.

To the paired data (length of cycle in days and first day of color) a line, referred to as the "regression line," has been fitted by the method of "Least Squares" to describe this average relationship. The line, fitted in this manner, in effect bisects the points of the scatter and keeps the sum of the squared deviations from the line a minimum. In the equation of the line, $Y = a + bX$, the first constant, a, determines the level of the line, while the second, b, indicates the units change in Y for a one unit change in X.

The regression equation of Graph 1, $Y = -10.17 + 0.79X$ indicates that for every one day that is added to the length of the cycle there is an increase of 0.79 days in the first day of color reaction.

In using this equation, values are substituted for X, the length of the cycle, which has been treated as the independent variable, and values for Y, the day of first color, are obtained. Thus, an individual with a 25-day cycle would most likely show first color reaction at 9.58 days, or between the ninth and tenth days, obtained as follows: $Y = -10.17 + (0.79)(25)$.

The range of the line plus or minus one standard error of estimate is also shown on the graph. The standard error of estimate is a measure of the spread about the line, and within a range of the line, plus or minus one standard error of estimate. Approximately two-thirds of the data lie within this area. In the example cited above, it was estimated that the 25-day cycle would show color on the 9.58th day. To cover possible variations, however, there may be added ± so many standard errors of estimate to the 9.58. Since a range of the

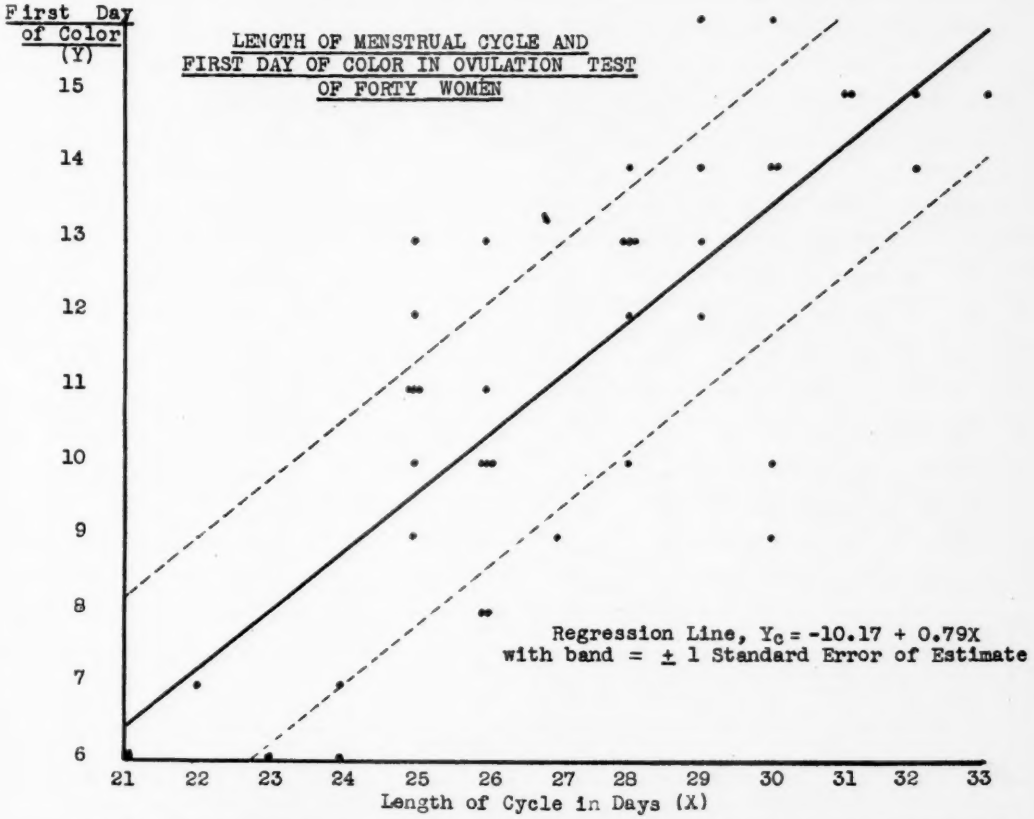
First Day of Color (Y)
LENGTH OF MENSTRUAL CYCLE AND FIRST DAY OF COLOR IN OVULATION TEST OF FORTY WOMEN
15
14
13
12
11
10
9
8
7
6
Regression Line, $Y_c = -10.17 + 0.79X$
with band = ± 1 Standard Error of Estimate
21 22 23 24 25 26 27 28 29 30 31 32 33
Length of Cycle in Days (X)

Fig. 1.—The first day of color reaction of forty women, each of whom experienced a normal reaction. The continuous diagonal line represents the days the ovulation process begins, in relation to the length of the cycle. The parallel broken lines represent, between them, the range of possible variation in which two-thirds of the data lie.

To determine time of ovulation in the normal cycle, read the length of the cycle on the horizontal axis. The first day of color is indicated by the value on the diagonal line immediately above this point, and ovulation time by including the first day of color plus two or three additional days for the entire positive color reaction of the test.

estimate plus or minus one standard error of estimate covers approximately two-thirds of the items, the chances are two to one that the observed value will fall within the band indicated by the dotted lines. The standard error of estimate for the 40 pairs studied is 1.8 days. If this be added to and subtracted from 9.58, there is found the range (7.78 to 10.38 days), within which the first day of color reaction will appear in two-thirds of the cases of women with 25-day cycles.*

*For the above forty paired items, the coefficient of determination is 0.60 and the coefficient of correlation 0.774. The application of the "t" test to these results indicates that the correlation differs significantly from zero.

TABLE IV. ABNORMAL REACTIONS*

SUBJECTS	LENGTH OF CYCLE (DAYS)	DAY OF MENSTRUAL CYCLE																				COLOR REACTION
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Group I																								
E. R. P.	25						0	0	0	0	0	0		0	D	0								No color
L. S. K.	25						0	0	0	0	0	D	0	0										No color
M. G. S.	25							0	0	0	0	0	0											No color
R. H. L.	26											0	0	D	0	0	0							No color
S. B. B.	28								D	0	0	0	0	0	D	0								No color
A. A.	28										0	0	0	0	0	0	0							No color
F. L. M.	28							0	0	0	0	0	0	0	0	0	0	D						No color
S. H. R.	29									0	0	0	0	0	0	0	D							No color
J. G. K.	29								0	0	0	0	0	0										No color
K. M. S.	31									D	0	0	0	0		D	0	D						No color
F. M.	32											0	0	D	D	0	0	0						No color
S. R.	35									0	D	0	0	0	0	0	0							No color
Group II																								
M. H.	25							D	0	D	+	0												One day
L. S.	28										0	+	0	0	0	0								One day
Group III																								
K. A.	26							0	0	0	0	+	+	0			0							Two days
W. H. H.	29										0	+	+	0	0	0	0	0	0					Two days
J. E.	32													0	0	+	+	0	0					Two days
Group IV																								
R. C. W.	22			D	0	0	0	+	0	+														Split
M. D. P.	25								0	0	+	D	0	+										Split
E. K. A.	25	0	0	0	0	0	+	0	0	+	0	D	0	0										Split
N. G.	25									0	+	0	+	0	0									Split
V. P. C.	25								+	0	0	D	0	+	+	0	0							Two days and split
H. E. S.	25								0	+	+	0	+	0	0	0	0							Two days and split
V. P. C.	25							+	0	0	D	0	+	+	0	0								Two days and split
M. H.	26											+	+	0	+									Two days and split
P. V. P.	26									0	0	0	0	+	0	D	+	0						Split
W. F. L.	26								0	+	D	0	+											Split
E. M.	27								0	0	0	0	0	D	+	0	0	0	0	+	0			Split
I. D.	27													+	0	+	0	0						Split
S. J. E.	28										+	0	0	0	+									Split
A. G.	28								0	0	0	0	0	0	+	0	D	+	0	0				Split
W. K.	28											+	0	0	+	D	0							Split
C. M.	28											+	0	0	+	D	0							Split
D. T.	29									0	+	+	0	+	0	0	0	+	0	+				Two days and split
F. D. M.	31								+	0	+	0	0	0	0	+	+	0	0					Two days and split
N. M.	32											0	0	0	+	0	+	0						Split

36 cycles; 34 different subjects.

+ = Positive color; 0 = no color; D = doubtful reaction.

*The abnormal reactions which occur in the rat's ovaries following its injection with the patient's urine. Group I shows no color reaction at all during the menstrual cycle. These patients are most likely anovulatory for the particular cycle. Groups II-IV show interrupted or split color reactions.

Patients with abnormal reactions of any kind failed to become pregnant when coitus was planned in relation to the ovulation reaction.

To determine visually the probable first day of color, one should read the length of the cycle on the *X* or horizontal axis. The first day of color will be indicated by the *Y* value of the regression line immediately above this point. The range within which two-thirds of the results should fall may be obtained by reading the *Y* values of the two dotted lines at the given length of the cycle.

Ovulation time is determined by including the first day of color plus two or three additional days for the entire color reaction in the test. For example, a cycle 26 days in length shows first day of color reaction on day 10, to which is added 11, 12, and 13, the three additional days of color reaction. Ovulation should in this case occur on day 13.

Assays.—As a check on the clinical aspect of the problem, in an effort to discover what is causing the color reaction, urine specimens were assayed for gonadotrophins.

The amount of gonadotrophin in the urine was assayed by Dr. A. E. Rakoff (method by Levin and Tyndale[29]) on two subjects when the reactions to the present test appeared.

TABLE V. ASSAY DETERMINATIONS OF GONADOTROPHIN*

DAY OF CYCLE	11	12	13	14	15	16
Subject 1 (First month)						
Two-hour rat test reaction		+	+	2+	+	0
Gonadotropic assay (Mouse units)		24	24	More than 96	None demonstrable	Specimen toxic for animals
Subject 1 (Third month)						
Two-hour rat test reaction	D	+	+	2+	D	0
Gonadotropic assay (Mouse units)	None demonstrable	20	None demonstrable	84	54	Not sent
DAY OF CYCLE	10	11	12	13	14	
Subject 2						
Two-hour rat test reaction	D	+	+	+	+	
Gonadotropic assay (Mouse units)	None Demonstrable	None demonstrable	Toxic specimen	Toxic specimen	42	

D = Doubtful reaction; + = positive reaction or hyperemia; 0 = no color reaction.
*Assay determinations by gonadotrophin made during the midcycle, when the two-hour rat test revealed color reactions.

Subject 1 (Table V) produced more than 96 mouse units of gonadotrophin on day 14 of the first month, on which day the rat test showed a two-plus reaction. In the following month a two-plus reaction was observed again on the fourteenth day. At this time there were 84 mouse units.

Subject 2 on day 14 produced 42 mouse units of gonadotrophin in the 24-hour sample. The urine samples showed a definite color reaction from days 11 to 14, by the two-hour rat test, and were reported toxic to the test animals in all but one instance by the assay procedure.

D'Amour[16] reported that at the time of ovulation the amount of gonadotrophin produced during a peak varied from 4 to 10 international units. (There is no international unit for pituitary gonadotrophin.) Dr. Rakoff[30]

Patients with abnormal reactions of any kind failed to become pregnant when coitus was planned in relation to the ovulation reaction.
of split color reactions.

stated that values between 16 and 32 mouse units of gonadotrophin are considered within the normal range. Occasionally at the peak of gonadotropic activity somewhat higher values may be obtained for a brief period. During the middle of the cycle, when the two-hour rat test showed increased color, the lowest amount of gonadotrophin produced was 20 mouse units, and the highest more than 96 mouse units. It is evident from these findings that the two-hour rat test is extremely sensitive to very small amounts of gonadotrophin in the urine of women at the period of ovulation.

Discussion

If hyperemia of the rat's ovaries follows injection of the patient's urine in the absence of coitus, and at the period in her menstrual cycle when ovulation might be anticipated, it is postulated that the presence of the hyperemia is an indication that ovulation is occurring. There is no irrefutable proof for this assumption, but accumulating evidence is strongly suggestive.

The positive clinical evidence in support of this hypothesis was the occurrence of conceptions in those women who appeared to be ovulating normally according to the present test; and the negative evidence that women who were not ovulating normally failed to conceive. In the case of one patient, a laparotomy performed on day 2 of the color reaction revealed a 16 mm. follicle, as predicted by the ovulation test previous to the operation.

On the basis of these findings, it might be assumed that ovulation occurs on or within twenty-four hours of the last day of the color reaction.

The experimental evidence in support of the hypothesis is as follows:

The ovulation test is based on the presence of hyperemia in the ovary of the immature rat after injection with the patient's urine. Several pure hormones were tested by the two-hour rat test in effort to establish the cause of the hyperemia. It was found that pure anterior pituitary hormones always produced a hyperemia in the rat ovary. Follicle-stimulating hormone (McShan), luteinizing hormone (Gurin), and follicle-stimulating hormone synergist (Schering) caused color reactions which could be measured differentially by the color scale in doses of from 3 to 25 rat units or equivalent. In doses larger than 25 rat units the maximum five plus color reaction was evident, and it was impossible to grade the increased color by measurement.

Estrogen was the only ovarian hormone that would occasionally cause a color reaction. It is probable that this secondary reaction resulted from the estrogenic stimulation of the pituitary gland, to produce luteinizing hormone, and the subsequent color reaction.

It is a well-known fact that ovulation is dependent upon the hormones from the anterior pituitary gland, namely, follicle-stimulating and luteinizing hormones. Since these hormones cause hyperemia in the immature rat ovary, this evidence suggests that they may be responsible for the hyperemia in the human ovulation test.

The hormone peak for gonadotrophin is an accepted criterion for ovulation, and our findings are in accord with the assay results. However, the assay

method is slow, troublesome, and postovulatory, and the question is raised whether or not ovulation occurs twenty-four hours after the gonadotropic peak.

The postovulatory phase for the subjects with normal reactions (Table III and Fig. 1) averaged twelve to fourteen days for cycles averaging twenty-one to thirty-three days in length. This observation supports the usual understanding that the corpus luteum phase of the menstrual cycle lasts approximately 14 days.

If it can be assumed that the present test can be employed as a means for establishing the time of ovulation, then some of its possible values are as follows:

It will record whether or not, in a given cycle, ovulation has taken place. Thus it will be possible to establish whether a patient ovulates every month and, if not, during just which months it takes place. As a consequence, in the case of couples who are suffering from relative infertility, such information will aid in determining the month during which conception is most likely to occur. Conversely, if it is desired to avoid conception, the tests indicate time when conception is least likely to occur.

Some women showed normal reactions regularly, suggesting that they had ovulated. The evidence for this statement lies in the observation that these patients became pregnant as a result of either coitus or artificial insemination. Other women exhibited some abnormal color reactions during the year, and it is assumed that they did not ovulate normally at those times. The evidence in support of this statement lies in the fact that conceptions never followed abnormal reactions. From these observations, it appears obvious that, should artificial insemination be contemplated, it should not be performed in the absence of a normal color reaction. The color test is of value not only in determining whether artificial insemination should be performed, but also in deciding the day in the cycle when it will be most successful. For example, one patient with cycles averaging twenty-seven days in length, was inseminated for three successive months on days 12 and 14, 13 and 15, 14 and 16 with no success. The two-hour rat test revealed the fact that ovulation had probably occurred on day 9; conception followed insemination performed on day 8 of the following cycle.

One of the chief values of the method lies in the fact that it indicates the beginning of the period of ovulation, which makes it possible to time intercourse for the single day during that period when it is most likely to be fruitful. This selection of the exact day for coitus in relation to ovulation time is important. Pregnancies have resulted in different cases when coitus took place on days 2, 3, or 4 of the color reaction. In most instances, day 3 has been advised. No pregnancies have resulted when coitus took place on the day following the last midperiod color reaction. When the husbands have low spermatozoa counts, it is important to determine whether the color reaction lasts three or four days. Coitus should be advised on the evening of the last day of color reaction. The spermatozoa in such cases probably have a shorter life span than usual, and must be deposited in advance of ovulation.

The success of the test depends upon careful attention to a number of factors. It should be emphasized that a single, tested, strain of animals should be employed. In our preliminary work we observed that certain other strains had ovaries that showed color previous to treatment of any sort, or frequently de-

veloped color through improper technique of handling during asphyxiation, such as failing to turn on the gas immediately, or removing the animal previous to death and replacing it in the chamber. The rats should conform to specific limitations with respect to age and size. Standard lighting conditions for reading the color reaction should be adhered to. If there is any doubt regarding the findings in any subject, the test should be repeated.

Summary and Conclusions

1. A method is described which appears to indicate (a) whether ovulation is occurring; and (b) when it is occurring.

2. Observations are reported upon 88 married and 12 single women.

3*a*. Most of these women showed a positive test for three or four successive days each month at the usually accepted ovulation time. This is termed the normal reaction.

b. A few women showed a positive test for one or two days at approximately this same period sometimes followed by a day or more of negative test, then a second positive test for one or two days. This is termed abnormal reaction.

c. A few women failed to show any reaction in any month.

4. Eighteen women complaining of sterility became pregnant during the months when they exhibited normal reactions. These observations suggest that the completion of a normal reaction indicates that ovulation has taken place.

5. Results thus far indicate the third or fourth day of a normal reaction as the time when insemination is most likely to produce pregnancy.

6. In our experience women have not become pregnant in months in which they exhibited no reactions or abnormal ones.

7. Urine assays showed gonadotrophin present when the hyperemic reaction was positive.

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DELAYED OVULATION, A SIGNIFICANT FACTOR IN THE VARIABILITY OF THE MENSTRUAL CYCLE*

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SUFFICIENT accurate data on the menstrual cycle have been accumulated to demonstrate that a recurrent 28-day cycle is an abstraction. Deviations occur to such an extent as to indicate clearly that the mechanisms controlling the cycle do not in fact function with an admirable lunar regularity. However much it may appeal to the neat and orderly to think in terms of a 4-week cycle, it is an injustice to the factual data: minor and even major deviations are not necessarily abnormal. Objectivity demands instead that we recognize the innate variability of all biologic processes and search for the causal factors involved. In the present instance this search calls for more complete controls than can be had in the clinic, and leads us to the laboratory and the macaque monkey,[7, 13, 14, 15] a primate whose cycle is essentially similar to the human. In this paper attention will be directed to one type of variation in the menstrual cycle brought about by late ovulation.

The extent to which fluctuations in cycle length occur has had a thorough statistical analysis by Gunn et al.;[11] their study was based on observations that were carefully checked for accuracy, a precaution usually neglected in studies of this sort. Notable exceptions are those of King[17] and Edward Allen.[3] In the group of 979 women studied by the Gunns, only 9 per cent belonged to the extremely regular type with differences of five days or less between the longest and shortest cycles. More than 20 per cent fell outside of the modal group in which cycles averaged 25 to 31 days. It appears that any woman may have an unusually long or short cycle at any time, and the chances that two successive cycles will be of equal length are negligible. A few long-term individual records have been analyzed by Richards[19] and the conclusion is drawn that fluctuations of 1 to 5 days are to be expected in all cases. Since a 28-day cycle occurs only about once in ten times, it is misleading to divide the continuous events of the cycle into 28 stages; the best we can do is to recognize a few phases which, like the entire cycle, are variable.

In order to reduce the inevitable discrepancies between the findings anticipated from the clinical histories and the actual specimens, it has been suggested that the human endometrium be dated from the "expected onset" of the next period rather than from the observed onset of the last. This involves the assumption that the postovulatory phase of the cycle is less variable than the preovulatory, which, in turn, presupposes accurate data on the time of ovulation in the cycle. Hartman[14] has shown how

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unreliable most observations on women are, and has indicated the necessity of using experimental animals for adequate controls. His method of rectal palpation[12, 13, 16] has provided direct and convincing data for the macaque monkey. Having detected ovulation time within a day or two, and knowing the dates of the previous and succeeding periods, he could compare the duration of pre- and postovulatory phases. His two series which total 145 crucial cases checked by laparotomies show that both phases are variable. The postovulatory phase ranged from 6 to 23 days, most cases falling between 9 and 17 days. These findings have been confirmed in principle by Corner.*

It is to be noted that these observations were made on normal animals in colonies with high fertility records, and that the menstrual flow following each ovulation was actually observed, not computed or estimated. It is accordingly unjustifiable to conclude that ovulation usually occurs at the middle of the cycle simply because the mode of the curve for ovulation time falls between 11 and 14 days, and the model length of the cycle lies between 26 and 29 days. Ovulation may occur early in a long cycle as well as in a modal cycle or late in a short cycle.[13, 16] So far as the macaque is concerned, the pre- and the postovulatory phases of the cycle vary independently of each other, and their variability is of the same order of magnitude as that of the cycle as a whole.

The irregularity in the postovulatory phase can be readily explained by a finding of Markee.[18] One of the outstanding discoveries in his studies of endometrium transplanted to the anterior chamber of the eye in macaques is the appearance of a profound premenstrual ischaemia. This preceded extravasation in every one of the 432 cycles he studied, and it always involved a reduction in the size of the transplant. The ischaemia varied both in duration and intensity, appearing as much as five days before the onset of bleeding or only one day before. If we correlate the ischaemia with the decline of activity in the corpus luteum, it would seem that this organ in the absence of pregnancy may "fail" suddenly and completely or only very gradually.

The ischaemic phase can readily be recognized histologically, and its variable duration can be correlated with the extremely variable histologic picture presented by the menstruating endometrium after ovulatory cycles. Thus, on day 1 the endometrium may be only 2 mm. thick, in areas where the surface is still intact, or it may be 6.7 mm. The glands may be "progravid" or narrow and simple in form. This statement is based on the study of 46 menstruating macaque uteri with complete histories and ovarian data from the collections of Corner, Hartman, Van Dyke, and Bartelmez. It is probable that similar conditions obtain in the human species where similar differences are found in menstruating mucous membranes.[4]

When and if a fully reliable external sign of ovulation in women is discovered, we will be in a position to gather data and judge to what extent the two species agree as to the relations of pre- and postovulatory phases.[14] It is not likely that there will be any fundamental differences.

*Contrib. to Embryol. 31: 117, 1945.

The present report is concerned with certain evidence provided by the macaque on the preovulatory phase of the cycle. Markee[18] states that after the end of a menstrual period the flow of blood and the growth of endometrial transplants may be promptly accelerated, or there may be a postmenstrual "resting" period lasting up to ten days. We have observed postmenstrual phases lasting much longer. They showed little evidence of endocrine activity. These occurred during the breeding season in normal, active macaques. The evidence appears in the following protocols.* The data on sex skin are included because when changes in color can be observed, they usually indicate changes in blood estrin.[1] The doubt that has been cast on their validity is due largely to the fact that the changes may not be apparent to the eye, though they are revealed when matched against color scales.

CASE 1.—(H314) This macaque, who had been notably regular in her cycles, menstruated from February 19 to February 23. The sex skin became strikingly paler during menstruation, and it remained pale for three weeks. On March 12 (day 22 of the cycle), the color began to brighten, and daily rectal palpations were done. On March 21 (30 days after the previous onset) ovulation occurred. Seventeen days later, on April 7 (day 48), a menstrual period began. This occurred 26 days after the return of ovarian activity as judged by changes in color of sex skin. The animal was sacrificed and the endometrium showed a typical ovulatory menstruation. The diagnosis made by G. W. Corner on the corpus luteum of the right ovary was "early degeneration as in menstruation."

CASE 2.—(B326) The January cycle was 25 days in length. It was anovulatory according to the palpation findings. The February flow persisted for 6 days. The sex skin color remained pale, and on day 13 both ovaries were small. On day 19 the color rose, but both ovaries were still small and remained so until day 25, when the right ovary began to enlarge. The color remained high, and on day 29 this ovary was definitely smaller and softer, indicating that ovulation had occurred on day 28. On day 32 the right ovary had again become larger, and on day 35 the animal was killed. The corpus luteum was 6 to 7 days old, and the endometrium presented an early progravid picture.

CASE 3.—(B318) The October cycle lasted 23 days; that in November, 22 days; and in December, 23 days. A menstrual period had begun on December 31 and ended January 2. Palpation on day 10 of the cycle indicated an enlarged ovary, so the animal was mated. On day 14 this ovary was definitely smaller, but it remained small, and neither pregnancy nor menstruation followed. This suggests the development in January of a Graafian follicle which became cystic and then slowly disappeared. The change in hormone level was presumably not abrupt enough to bring about menstruation.[18†] On day 23 the right ovary had again enlarged, and ovulation was diagnosed between days 29 and 30. When the animal was sacrificed on day 42, a mature corpus luteum was found on the right. The endometrium presents the first signs of the premenstrual ischemic phase, so that menstruation was imminent.

CASE 4.—(B317) In October ovulation was diagnosed on day 22, and the next flow appeared 16 days later (38-day cycle). During the postmenstrual phase, the sex skin color remained consistently high (Tallquist hemoglobinometer rating 60). The next ovulation was diagnosed between days 36 and 37, and on day 41 a fresh corpus luteum was observed at laparotomy. Fifteen or 16 days after ovulation (day 52), menstruation began and both corpus luteum and endometrium presented histologic pictures typical of early menstruation.

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*We wish to express our indebtedness to Dr. David B. Clark for help in making these observations.

†This type of abortive cycle was first described by Hartman[12] (Staircase phenomenon) and probably accounts for many cycles which are about twice the modal length.

TABLE I. CASES WITH LONG POSTMENSTRUAL PERIODS OF OVARIAN INACTIVITY (MACAQUE)

NO.	DAY OF OVULATION AFTER ONSET OF PREVIOUS MENSTRUATION	TOTAL LENGTH OF CYCLE IN DAYS	AVERAGE OF PREVIOUS CYCLES	REMARKS
I (B314)	30	48 (Feb.-Mar.)	26 (range 24 to 28)	Postovulatory phase, 18 days
II (B318)	29 or 30	Estimated 43 (Jan.)	32 days (range 22 to 58)	Premenstrual ischemic endometrium
III (B317)	36 or 37	52 (Nov.-Dec.)	28 days (range 22 to 45)	Menstruation 15 to 16 days after ovulation
IV (B326)	29	Estimated 42± (Mar.)	25 days (only one cycle observed)	6-day-old corpus luteum obtained on day 35. See the similar case 94 of Brewer and Jones[6]
V (B211)	21 to 23	Estimated 36± (Dec.)	41 days (range 25 to 60)	Panhysterectomy on day 27. Corpus luteum 4 to 6 days old
VI (H376)	26	Estimated 41± (Oct.)	Previous cycle ovulatory	Newly ruptured follicle and follicular phase endometrium removed on day 26

CASE 5.—(B211) A menstrual period lasted from December 16 to 21. Both ovaries were small on days 13 and 16 of this cycle. On day 21 the left ovary was found enlarged, and on day 23 recent stigmas were observed in both ovaries at an exploratory laparotomy. On day 27 a panhysterectomy was done and each ovary had a corpus luteum estimated as 4 to 6 days old by Dr. Corner.

CASE 6.—This case was added to Table I with the permission of Dr. Hartman. It is as clear a demonstration of normal ovulation during the fourth week of a cycle as could be wished.

These specimens show no evidences of abnormality in either uterus or ovaries. Four of them were collected in a single season from a colony of some 30 mature animals. In the Corner, Hartman, and Van Dyke collections, there are at least six long preovulatory phases; in two, ovulation was demonstrated on days 17 and 23, respectively;[13, 16] in four no ovulation had as yet occurred on days 17, 17, 19, and 24. These might have belonged to anovulatory cycles, but numerous mitoses in the endometrium suggest that ovarian activity had been resumed and that ovulatory cycles had begun. It would seem then that in the macaque, delayed ovulation is not rare.

There are reasons for believing that delayed ovulation also occurs in women. The most convincing are to be found in Hartman's[14] review of normal early pregnancies with exceptionally reliable clinical histories. In 18 of the 54, that is, one-third, ovulation occurred between the 18th and 24th days of the cycle. In a group of 30 women with normal pelvic organs reported by Greulich, Morris, and Black,[10] there were no large follicles or corpora lutea present in fourteen examined at laparotomy betwen days 13 and 19. Brewer and Jones[6] report a 5-day-old corpus luteum (case 94) removed 38 days after the last period. In Fluhmann's[9] study of cycle length, 10.5 per cent of 747 cycles fell between 36 and 50 days. Some of these could be ascribed to delayed ovulation, if anovula-

tory cycles are as rare in women as we are led to believe. Others might be cases with a long-lived corpus luteum such as Hartman[16] has described.

Instances of ovulation have been adduced for every day of the conventional 28, and it has accordingly been argued that ovulation has no definite locus in the cycle, but may occur at any time. Many of the "aberrant" cases can be accounted for by delayed ovulation. Thus, if the postmenstrual inactive phase varies in duration, the subsequent ovulation may occur on any day of the third or fourth week after the last observed menstrual flow. The rare cases of ovulation during or immediately after bleeding can be explained on the same basis. If there is a latent period of three weeks or more, and the return of ovarian activity is followed by the ovulatory (intermenstrual) type of bleeding,[12] this might readily be misinterpreted as a light menstruation, and consequently a follicle be supposed to have ruptured during the catamenia. Variability in the time of ovulation is no good reason then for questioning the causal relationship between the various events of the menstrual cycle.

All the information we have at present indicates an infertile period in women, but only *statistically*.[2, 5, 14, 20] A woman who requests advice on this subject may ask, "What are the chances in my case that an ovulation will occur three or more weeks after a period?" There is no pat answer, even if she has kept a menstrual calendar for years. Many "failures of the safe period" can be ascribed to our ignorance of the incidence of delayed ovulation in women. There are 16 cases which can be so interpreted in our Culbertson Collection of human endometria from 300 successive hysterectomies.

Gunn, Jenkin, and Gunn[11] have pointed out that the variability in cycle length is like that of any character which is determined by many diverse factors. Variability in the pre- and postovulatory phases is to be expected if they are controlled by an oscillating system of balanced endocrine forces. As in the parallelogram of forces, the configuration of such a system as a whole is necessarily modified by every change in any one of the component forces. We are dealing not with a machine of levers and gears, but with a system of living organs. The activities and susceptibilities of one or more may change from month to month and, as a result, the time relations vary. The resultant state of a "target organ" like the uterus also varies. There is no reason for regarding the postmenstrual periods of ovarian inactivity as abnormal. They are integral features of the variability of the preovulatory phase and should be considered as comparable with the quiescent (anestrus) periods such as characterize the reproductive cycles of most mammals.

Summary

The pre- and postovulatory phases of the menstrual cycle are as variable in length as the cycle as a whole in the macaque (Hartman).

Such variability can readily be explained in a cycle controlled by a balanced system of endocrine forces.

Ovulation is demonstrated on the 21st to the 23rd, 29th, 29th to the 30th, 30th, and 36th days after the onset of normal menstrual periods in a colony

of healthy, mature macaques. There is evidence that such delayed ovulation occurs more frequently than these five crucial cases would indicate.

Delayed ovulation in these cases was due to a postmenstrual period of ovarian inactivity.

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SEMEN ANALYSIS IN 1,500 CASES OF STERILE MARRIAGE*

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DURING the past few years at the New York Hospital and Cornell University Medical College, we have examined approximately 1,500 semen specimens obtained from different individuals whose wives were undergoing examination for sterility either in the clinics of the hospital or in the offices of private physicians. We believe that the results of these semen analyses have considerable value, inasmuch as the tendency in recent years has been to apportion more blame to the husband in sterile marriage. This shift in emphasis is due in great part to increasing knowledge of the physiology of human semen, particularly from the work of Cary,[1] Moench,[2] Hotchkiss,[3] Williams,[4] and others. A gradual accumulation of data has drawn attention to the significance of the spermatozoa count, the motile activity of the spermatozoa, and the morphologic characteristics of the cells. In spite of the evolution of such standards, there is still considerable debate about the relative significance of each characteristic of the semen. One group of opinion considers that abnormal spermatozoa morphology is of prime importance, another the spermatozoa count per unit volume, while yet another is content to view the semen specimen as a whole and to judge its potential fertility on a broad basis.

We believe that the latter approach is the logical one, though it is obvious that no real conclusion can be reached until the histories of both partners in sterile marriage are studied intensively and a mass of statistical data obtained which will allow us to apportion the responsibility more adequately than we can at present. We require, particularly, more knowledge of what can be expected of semen specimens from apparently normal young men in the age group of 20 to 35, and to compare such figures with the data to be presented here, namely, the characteristics of the semen of men in sterile marriage. In this and other related studies, we hope to present data which will throw more light on a problem which is assuming increasing importance.

Methods

The semen specimens were obtained at least three days, preferably longer, after the last emission. The patients were supplied with a clean, wide-mouthed glass container and instructed to obtain the specimen by masturbation if possible; if not, then by interrupted intercourse.‡ They were cautioned against losing any of the first part of the ejaculate, since it has been shown[5] that most of the spermatozoa appear in the first third of the ejaculate and that the motility of the spermatozoa in the terminal portion is likely to be impaired.

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†Dr. Hotchkiss is now in service in the U. S. Navy.

‡It should not be necessary to emphasize that a condom specimen is likely to prove grossly misleading inasmuch as motility is badly impaired or destroyed by such a method of collection.

The semen specimens were brought to the laboratory within two hours after ejaculation and examined immediately for volume, the quality of motility, and the percentage of active spermatozoa. The motility determinations were done according to the method of Hotchkiss.[3] It should be noted that this method gives separately an appraisal of the quality of motility and the percentage of active cells.* In a normal specimen, full active should be maintained for at least three hours. Motility determinations were made at three, six, nine, and twenty-four hours. Any abnormality in viscosity was noted when the volume was taken.

In counting the spermatozoa, the technique described by Macomber and Saunders[6] was followed.

The morphology of the spermatozoa was studied by the method and using the criteria of Hotchkiss.[3] Where possible, three hundred spermatozoa were examined, though in many specimens with low counts this was not feasible. We also have found the staining technique of Greenberg et al.[7] to be valuable in these studies, particularly since with this method a stained smear ready for study can be obtained in two minutes.

Under the heading "poor motility" we have grouped semen specimens in which the motile activity of the spermatozoa was less than a quality of three and/or where only 40 per cent or less of the spermatozoa were active. This type of motility is decidedly subnormal.

In grading the morphologic characteristics, we have placed the normal limit as under 20 per cent abnormal forms, and characterized all semen specimens with 20 per cent or more abnormal forms in the subnormal class. This does not imply that the latter semen specimens necessarily are infertile but only that, so far as morphology is concerned, they are considerably below the average normal semen specimen (MacLeod and Heim,[8] and Moench and Holt).[2]

Details of Semen Analysis

The figures in Table I present a characteristic of the semen analysis which hitherto has not received much, if any, emphasis. It will be seen that as the spermatozoa count falls, other defects in the semen increase almost in proportion. For example, in the presence of counts of 100 million per c.c. or more,

TABLE I. SEMEN ANALYSIS IN 1500 CASES OF STERILE MARRIAGE

SPERMATOZOA COUNT/C.C. IN MILLIONS	NO. OF CASES	SUBNORMAL MOTILITY (3- OR LESS AND/OR LESS THAN 40% MOTILE)	SUB-NORMAL MORPHOLOGY (20% OR MORE ABNORMAL)	SUB-NORMAL MOTILITY AND MORPHOLOGY	SUB-NORMAL MORPHOLOGY WITH GOOD MOTILITY	NUMBER POOR NOT CONSIDERING COUNT	SATISFACTORY SPECIMENS*
100+	453	103 (24%)	41 (9%)	28	13	116 (25%)	337 (74%)
80-99	117	25 (21%)	18 (10%)	8	10	35 (30%)	82 (70%)
60-79	156	56 (36%)	20 (13%)	13	7	63 (40%)	93 (60%)
40-59	171	76 (45%)	52 (32%)	36	16	92 (54%)	
20-39	175	117 (67%)	58 (33%)	35	22	139 (79%)	
1-19	272	221 (81%)	?				
Azoospermia	156						

*Of 1,500 semen specimens, only 512 (40%) were completely satisfactory.

*Appraisal of quality is a matter of experience. Speedy and undeviating progress across the high power microscopic field is the prime requisite of normal motility.

25 per cent of these specimens were poor in terms of motility and morphology and poor, therefore, in terms of potential fertility. In specimens with counts between 80 and 100 million per c.c., 30 per cent were unsatisfactory for the same reasons, not a significant increase. However, in the 40 to 60 million per c.c. class, defects apart from the count rise to 54 per cent, and in the 1 to 20 million group at least 81 per cent of the specimens are deficient in both motility and morphology. In most of the latter cases, we were not able to do adequate morphologic examinations because of the sparsity of cells and we believe, therefore, that a percentage of 90 would better represent the number of specimens deficient for reasons other than count. Fig. 1 demonstrates in graphic fashion the increase in other defects with decrease in counts.

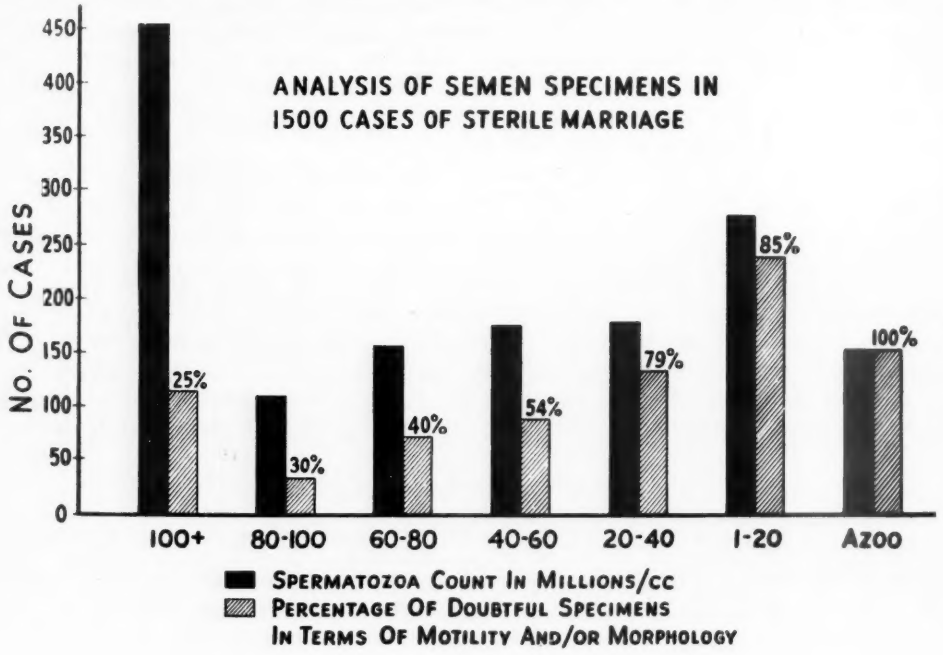

Fig. 1.

These figures have considerable value in displaying what might be expected of semen specimens in sterile marriage. But their greatest interest and worth derives from a comparison of this data with those obtained from men of known fertility and from apparently normal young men. Hotchkiss et al[9] have published figures obtained from 200 fertile men whose wives were in the first half of gestation, and MacLeod and Heim[8] give data from apparently normal young men. Table II summarizes and compares the figures for volume, spermatozoa count, and morphology of the three different groups.

Table II. Summary of Semen Quality in Various Male Groups

Author and Group	Volume of Ejaculate (c.c.)	Spermatozoa Count in Millions/c.c.	Total Spermatozoa Count in Millions	Morphology % of Normal Forms
Hotchkiss et al. (Fertile Marriage)	3.0	120.5	360	89.8
MacLeod and Hotchkiss (Sterile Marriage)	3.2	94	277	87.0
MacLeod and Heim (Unmarried Men)	3.4	134	435	90.0

The average volume of the ejaculate is quite similar in all three studies. Generally speaking, we found negligibly few cases in which low volume could be considered as the source of infertility.

The average spermatozoa count per c.c. and total count show all three groups to be satisfactory by present standards. It should be noted (Table I) that 10 per cent of the "sterile marriage" group were azoospermias. In calculating the mean spermatozoa counts in this group we have not included the azoospermias, so that the average counts presented represent only those semen specimens with spermatozoa present. In spite of this allowance, the average spermatozoa counts of this group are considerably, but not seriously, lower than the others. The highest counts are found in the unmarried group, but when compared to the "known fertility" group, the difference is not unduly significant. In other words, looking broadly at the average figures of all three groups, the average spermatozoa count in the husbands of the "sterile marriage" group is satisfactory, if not good, by present standards. Similarly, one can find no significant difference in the average percentage of spermatozoa of normal structure in the three groups. Therefore, in considering these two characteristics of the semen, the average figures do not indicate the true state of affairs. It is rather in the count distribution that significance appears. For example, if we take the 60 million per c.c. count level arbitrarily as the point of demarcation, it has been shown[9] that 25 per cent of a group of men of known fertility had counts below this level. Similarly,[8] only 22 per cent of a group of apparently young men had counts below 60 million per cubic centimeter. Whereas, in the sterile marriage group, 49 per cent of the semen specimens were in the lower count brackets.

It is generally agreed[6, 10] that the best chances of conception are found in specimens with counts of 100 million per c.c. or over. Thus, in the group of fertile men, Hotchkiss et al.[9] found that 60 per cent of their men fell in this category, and MacLeod and Heim[8] found 65 per cent of the men in their younger age group had counts of 100 million per c.c. or over, a rather striking difference.

Simmons,[11*] in a recent study of the semen in 500 men in sterile marriage, has data which corresponds very closely with the figures presented here. Using essentially the same techniques and standards, he found, for example, that 47 per cent (we found 49 per cent) of his semen specimens had spermatozoa counts below 60 million per c.c. Semen specimens with 100 million per c.c. or over comprised 37 per cent in his group as compared to 30 per cent in our group. Taking all the characteristics of the semen, Simmons finds that only 40 per cent of the males in his group had satisfactory semen specimens, a figure which coincides exactly with ours. It should be pointed out, however, that Simmons and we found specimens unsatisfactory for different reasons. Simmons places considerably more emphasis on defects in morphology in that he found 28 per cent of the total number of specimens examined to have defective morphology, while we have classified as such only 18 per cent. Inasmuch as we have used the same figure (20 per cent or more abnormal forms) as the point at which to consider a specimen as having subnormal morphology, it is obvious that Simmons uses more rigid criteria in characterizing a spermatozoon as normal or abnormal. Similarly, in regard to motility, our standards must be different in that 35 per cent of our total number of cases were considered defective in motility, whereas Simmons found only 20 per cent. So that, although we obtain the same percentage of unsatisfactory specimens, we do so in certain instances for different reasons.

Keshin and Pinck,[12] in a study of 135 cases of men in sterile marriage, consider that 68 per cent of the semen specimens examined were unsatisfactory, a

*I am deeply indebted to Dr. Simmons for the privilege of reading his manuscript while his paper was in press.

very high figure indeed. They, like Simmons, considered abnormal morphology a more serious problem than subnormal motility, so much so that 25 per cent of their total series are classified as defective because of abnormal morphology.

Azoospermia

In his 536 cases, Simmons found that 71 (13 per cent) were azoospermias. But, of 135 cases, Keshin and Pinck had a total of 25 (18.5 per cent). We found 156 cases (10 per cent) in our group, though the percentage figure is higher (15 per cent) if we consider only cases seen in the hospital clinics. Gonorrhea is considered in most texts as the most common cause of sterility in the male, but Simmons points out that in only 18 of his 71 cases of azospermia was gonorrheal epididymitis the probable cause of the sterility. Keshin and Pinck do not subclassify their cases. Our case histories are not complete because, in many cases, testicular biopsy, the only confirmatory measure, was refused. However, if we take only the clinic cases, of which we have 577, 88 were definitely azoospermias. Of the 88 cases, 50 (or 56 per cent) had a history of gonorrhea, 29 were either hypogonads or cases of bilateral cryptorchidism, and nine were of obscure etiology. Thus, in our clinic cases, the percentage of azoospermias with a history of gonorrhea is rather high, though the lack of testicular biopsy in most of these cases makes the evidence that gonorrhea is the cause of the sterility only presumptive. There is little doubt that a number of these cases would have had poor semen specimens in the absence of the gonorrhea history or bilateral obstruction. It is equally true, however, that the probability of a congenital azoospermia being found in the presence of bilateral obstruction due to gonorrhea is not high. It is of interest to note that a much higher percentage of cases of azoospermia are found in our clinic cases (15 per cent) than in the private patient group (7 per cent). It is also true that histories of gonorrhea are much more frequent in the clinic group. We agree with Simmons that, taking the male population as a whole, gonorrheal epididymitis is not the most common causative factor in azoospermia, though it might well be so in restricted groups.

Relation Between Abnormal Semen Viscosity and Sperm Motility

Abnormally high viscosity is a frequent finding in examinations of the seminal fluid, and it is pertinent to ask if subnormal motility is correlated with such a finding. Our evidence suggests that there is no such correlation. For example, in 500 individual examinations, 50 specimens were found with a marked increase in viscosity. Of these specimens, 24 had spermatozoa counts above 60 million per c.c. and, of these, only three had unsatisfactory motility. We have already shown that, apart from the viscosity factor, motility defects increase markedly when the count falls below 60 million. It would seem, therefore, that if the spermatozoa are intrinsically good so far as motility is concerned, an abnormally viscous seminal fluid is not likely to affect that quality.

Insofar as the ultimate functioning of highly viscous semen in the female genital tract is concerned, we believe that if the in vitro quality of the sperm motility is good, the spermatozoa will migrate from viscous semen into the cervical canal just as readily as from semen of normal viscosity.

Type of Semen Specimen Eventually Producing Conception

In the sterile marriage group reported here, we have complete histories on 140 cases in which 24 pregnancies eventually took place. Undoubtedly, many others have resulted which are not reported either to the clinic or the private physician. Of those recorded, we have complete histories on the husband and wife and it is of considerable interest to examine the data, particularly in

TABLE III. ANALYSIS OF 142 HISTORIES OF BOTH PARTNERS IN STERILE MARRIAGE

BOTH HISTORIES GOOD	WIFE'S HISTORY GOOD HUSBAND'S POOR	HUSBAND'S* HISTORY GOOD WIFE'S POOR	BOTH HISTORIES POOR	SUBSEQUENT PREGNANCIES
34	43	28	14	25

Of 25 pregnancies which occurred subsequently in this group:
16 (or 54%) took place where histories of both partners were good.
7 (or 28% took place where wife's history was good and husband's semen was poor.†
1 occurred where husband's history was good and wife's poor.
1 took place in presence of poor histories in both partners.

*Semen specimens of husbands averaged 127 million spermatozoa/c.c.
†In these cases the count details of the semen specimens are:

	1.	2.	3.	4.	5.	6.	7.
Millions/c.c.	5	26	20	23	50	45	48

terms of the semen specimen. Table III gives the number of pregnancies occurring in the different history categories. At the time of original examination, the average number of years of infertility was 2.6. Conception eventually took place in these cases sometimes two to three years after initial examination, so that the years of infertility really average higher than 2.6.

Where the husband's semen specimen was unsatisfactory on the initial examination at least another one, and in many cases 3 or 4, repeat tests were done. The male partner was considered of low fertility when the spermatozoa count was consistently below 60 million per c.c. or other defects, such as in motility or morphology, were obvious.

It will be seen that the greatest number of pregnancies (60 per cent) occurred eventually in cases where no fault could be found in the wife and where the husband's specimen was good. So far as this report is concerned, the average figures for these semen specimens are significant. The spermatozoa count averaged 127 million per c.c. (low 62 million, high 220 million), the motility in every case was good, and the normal forms averaged 90 per cent.

In only one other history category did a number of pregnancies (7, or 29 per cent) eventually result, namely, where the wife's history was good and the husband's relatively poor. The average figures for the semen specimens of these husbands are 31 million per c.c. (high 50 million, low 5 million). In at least three of these cases the motility, too, was subnormal.

It is obvious from these results that one cannot arbitrarily forecast the fertility of any semen specimen provided spermatozoa are present. Nevertheless, it is just as obvious (and perhaps axiomatic) that the chances of conception are considerably better when the spermatozoa count is in the count level above 60 million per c.c. This fact is brought out strikingly when we see that where the histories of both partners were good, pregnancies eventually resulted in 15 (or 65 per cent) of the cases. Whereas, where the wife's history was good and the husband's poor, pregnancies eventually occurred in 7 (or 16 per cent) of the cases.

It is of interest, too, to point out that in 28 cases where the semen specimens were good but the wife's history poor for one reason or another, only one pregnancy eventually took place. It would seem, therefore, that if the wife's history is good, the chances of conception eventually taking place are reasonably good (one in six) even though the husband's semen specimen does not measure up to normal standards. One normal pregnancy eventually resulted in the latter group from a semen specimen which contained only 24 per cent normal spermatozoa—64 per cent of the spermatozoa being of the "tapering" type, classified by most authorities as abnormal.

Abnormal Morphology

Throughout this analysis we have found no convincing evidence that a high percentage of abnormally-shaped spermatozoa in any given semen specimen was the *sole* responsible factor. We have isolated cases on record where, in the presence of a good spermatozoa count and adequate motility, the morphology has been grossly abnormal in the sense that only about 10 per cent of the spermatozoa showed normal structure. But such cases are rare, and when they occur we have little hesitancy in ascribing the failure of conception to this one factor. But, as we believe the figures show, one defect in the semen specimen is usually accompanied by others, hence our reluctance to single out abnormal morphology as a serious, *single* factor in male infertility.

Discussion

One of the significant features of the data presented here is that in this large series of cases, so many semen specimens are defective by present standards. If we compare these figures with apparently normal standards in the literature we find, for example, that in a group of 200 men of known fertility, 25 per cent were found to have semen specimens with counts consistently below 60 million per c.c.[9] In another group of 100 apparently normal, young, unmarried men, the average spermatozoa counts were just slightly higher than those given for fertile, married men, and 22 per cent had spermatozoa counts consistently below 60 million.[8] In these two groups, therefore, the average semen characteristics were surprisingly similar. We have shown in this sterile marriage series that the average semen characteristics are considerably below the level of the two groups referred to above though the average figures are still acceptable. However, more than 50 per cent of the semen specimens examined had spermatozoa counts below 60 million per c.c. as compared to 25 and 22 per cent in the normal groups. Six hundred and eighteen, or 41 per cent, of the total number of men examined had subnormal spermatozoa counts; and it is in this group, not the completely sterile group with azoospermia, which constitutes the main male sterility problem. Most of these men have normal histories. Except in certain of the azoospermias, no clean-cut etiologic factor (or factors) has emerged to account for the considerable amount of male infertility recorded in this investigation.

Summary

1. Examination of semen specimens in 1,500 cases of sterile marriage showed that about 50 per cent had deficiencies either in spermatozoa count, motility, or morphology.

2. As the spermatozoa count falls below 60 million per c.c., other defects, such as motility and abnormal morphology, become more apparent until, in the very low count range, all three deficiencies together are likely to be found.

3. Where successful pregnancies eventually occurred in this large group, the greatest number were found where no obvious fault was apparent in either partner and where the spermatozoa count was consistently in the higher brackets.

4. It is suggested that the 60 million per c.c. spermatozoa count level is a reasonable dividing line between good and impaired fertility.

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WEIGHT CONTROL, DIET, AND FLUID BALANCE IN PREGNANCY*

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THROUGH years of experience in a chosen type of work, one begins to evolve for oneself a pattern of what he believes is the proper course to pursue to secure an ideal end result. From observation and experience, we unconsciously set a routine that strikes us as meeting this criterion. In many instances, self-evident facts and procedures of worth are overshadowed by the more spectacular discoveries of modern times. A new extraperitoneal approach to the lower uterine segment, or a new wonder drug, overcomes a serious obstacle to success, and the old time-worn procedures are allowed to pass unnoticed, especially if they lack the glamour of the spectacular. By this indifference to simple things, we often produce the difficulties that the newer things were invented or discovered to correct.

It is felt here, for example, that the proper control of the diet, weight, sodium-ion intake, and the proper supply of vitamin foods and adjuvants, plus exercise, are extremely important. These factors are, in themselves possibly, the very basis for the prevention of so-called "toxemia" of pregnancy and can reduce the incidence of dystocia.

For years we have been impressed with several self-evident facts. (1) While not every woman gaining weight excessively gets into trouble, the greatest number of those who develop toxemia or dystocia do gain inordinately. Very possibly, these difficulties are due to this fact. (2) The patient who gains little weight usually has a shorter labor and much less obstetric complication.[1] (3) Efforts to control weight in order to lessen the size of the baby have repeatedly been failures; so in reverse, patients may be dieted without any appreciable effect on the size of the baby.[6] (4) The offspring of women in privation are no smaller or poorer than the offspring of their more fortunate sisters; in fact, they are often more rugged. The baby is, after all, a parasite. (5) The generally accepted fact that pregnant women need far more protein than normal in order to protect their liver and to maintain proper blood serum protein is true. (6) The excellent results that have accrued through the real enforcement of fluid balance and restriction, and especially dehydration in their proper place, are accepted in this institution.[8] (7) The importance of exercise is conceded as important to proper body function. (8) The effect on the woman herself is very important. It is the nature of woman to be the attractor, and, whether married or not, she instinctively desires the utmost in the physical perfection with which she was originally endowed. Any obstetrician who allows a woman to lose her attractiveness is depriving her of many things that make for her mental well-being, her husband's contentment, and her own personal satisfaction. There is nothing

*Read before the Brooklyn Gynecological Society, October 5, 1945.

more satisfying than the gratitude of the woman who has been carried through her gravid state and is as well and as attractive as she was before. We have been successful, in all patients who have been willing to cooperate with us, in having the weight the same as when they started, or the difference of a pound or two either way.

After the appearance in *Surgery, Gynecology and Obstetrics,* August, 1932, of the paper by Arnold and Fay[3, 4] of Temple University, Philadelphia, describing the so-called "Temple Treatment" of eclampsia, the Obstetrical Department of St. Mary's Hospital as then constituted, and in conjunction with the medical department, decided to evaluate the results in our, then, relatively frequent eclamptic cases. The results were so striking that it was reasoned that if this could and does cure, prophylactically, it should prevent all the symptom complex. Again, many observers have suggested the importance of sheer weight as a factor in "toxemia."

With these thoughts in mind, it was decided several years ago to enforce a strict regimen on private patients. The reasons are carefully pointed out to them, namely: the dangers of excessive weight; the possibility of long, hard labor; the possibility of "toxemia"; the desirability of maintaining physical appearance after the gravid state is ended; the comfort that these persons have while they are pregnant; and the ease of accomplishing normal activities. They are, of course, in the beginning extremely enthusiastic, and many carry on willingly, faithfully, and get the desired result. Others—the spoiled ones—usually gain weight, rebel, and it is only by threats and their husbands' help, that we are able to make them toe the mark. As a result, all of these women, even the rebels, are delighted with the result.

In order to evaluate properly this regimen, I have taken 325 consecutive cases that have passed through my office and have been subject to this method of treatment. Not included were patients seen in consultation at the hospitals and patients referred in the last minute without data. There were some patients referred by doctors who have gone into the service, and others who have come in mid-pregnancy and who had already gained weight excessively. These latter were included and are the source of most all of the heavy gains. There were several who came to see me after therapeutic abortion had been advised for hypertensive vascular disease, heart disease, etc.

In the beginning the weight allowance was 20 pounds, and later it was reduced to 15 pounds as the top weight gain for the average woman; but, the larger the woman, the less the gain allowed, and for the unfortunate obese, the ideal was no gain whatsoever.

Procedure

After the general instructions to the patient as to what is expected of her and the results that she may expect from complete cooperation, she is given the usual complete medical and obstetric examination. The proper diet is stressed and she is told how to provide herself with the proper food intake. Here, this means a high protein diet, that is, protein ingested three times a day, which is supplemented by a diet that is low in carbohydrate, high in green and yellow vegetables, fruit, and certified milk, either skimmed or whole, as the diet in-

dicates. In this way, sufficient protein is ingested, sufficient vitamins and salts are included, and carbohydrate is provided in sufficient amount through the ingestion of the vegetables and fruit. All of the heavy starches are absolutely eliminated until we find just what the woman's food requirement is. This must be determined because many women can eat enormous quantities of food in the nonpregnant state without gaining a pound, but pregnancy produces a tremendous gain which must be controlled. Added vitamins are provided and, by frequent office visits, her weight is maintained so that in her first four or five months she is permitted only a maximum gain of one-fourth pound per week, and if she is obese, she is permitted no gain at all. This early diet regulation is important because in the latter months of pregnancy, as the woman becomes more sedentary, she is apt to put on excessive weight. This is not readily controlled because the restriction in diet has not been started early enough. The patient is seen at least every three weeks at first and, if she is a diet problem, every week until she strikes a proper average. These patients, if gaining beyond their allowance, are put on a 1,200 calorie diet plus added vitamins, which is almost exclusively protein and largely vegetable. More food is later added, and her total caloric requirement found so that she will gain the allowed progressive amount. Salt is not restricted in the early months, except the ingestion of highly seasoned things, and the excessive use of salt is forbidden. Later, salt is permitted only in the preparation of food. Fluids are important. The woman who can metabolize water is, of course, the usual type. In pregnancy, however, women's water metabolism is notoriously unsatisfactory, and patients are repeatedly checked as to the amount of fluid they take against the amount of urine they excrete. If there is a sudden weight gain the fluid balance is checked. This is done especially in the woman who has been gaining satisfactorily and suddenly shows a pound or more gain, with or without transient edema. This means that she must at intervals measure her intake and output. Her fluid intake is *restricted to her previous day's output.* The salt is withdrawn and, if her fluid intake and output does not satisfactorily balance, she is instructed to take magnesium sulfate every morning to produce free fluid evacuation. I have never seen any harm from this procedure, and these patients themselves remark how well they feel. It is surprising the amount of fluid these patients can lose, as evidenced by weight loss. Their intake is then increased, and if they are able to metabolize a fair amount of fluid, it is allowed, and a balance struck which seems to be best for them. It is also amazing how comfortable they are, how the lassitude disappears, and, what is more important, how often they will ask to be put back on this routine because they feel so much better. In passing, no patient is allowed to take less than 20 ounces of fluid a day. This, of course, does not mean water allowance alone, but means water in any form, such as tea, soup, milk, or other liquid. One thing we must always watch for carefully is edema, which becomes marked or persistent in spite of this routine. Patients with edema usually belong in either one of two groups: they either eat little protein, or they are heavy protein eaters when not pregnant, and require a great deal more when gravid. Either one of these may get a simple nutritional edema which is alarming unless properly evaluated; also, this may be the first evidence of liver dysfunction. This type of patient persists in having edema beyond a few days, which is not markedly relieved by dehydration. She balances well and has no other evidence of damage; for example, rise in blood pressure, or albuminuria. These patients are hospitalized to make sure that they are maintaining the proper regimen. Almost invariably we find a severe hypoproteinemia. The serum-albumin and serum-globulin ratio is reversed and the serum-albumin is below two. These patients, of course, are headed for trouble. It is not known at this stage, whether their hypoproteinemia is an evidence of liver damage or dysfunction, and is thus an early stage of toxic disease, or

whether it is simply some type of nutritional or ideopathic edema, but it calls for immediate control. These patients are put on a very high protein diet supplemented with hydrolysate of protein, and are given an infusion of whole plasma (500 c.c.) by vein. This is not the ordinary plasma which is used in shock. Our blood bank prepares this pooled plasma just for this purpose. In ordinary plasma for shock therapy, the 500 c.c. is made up of 250 c.c. of ordinary pooled plasma and 250 c.c. of saline. In this instance there is no saline added, and the whole 500 c.c. is pure plasma. It is remarkable how quickly the edema lessens, the weight decreases, and the woman voids an appreciably increased amount of urine. None has required a second transfusion nor any further treatment, except a continuation of balance. Amigen is not used. It is, of course, ideal in that it includes all the amino acids necessary for growth and development, but amigen in its present state can be given only in solution, and requires 1,000 c.c. of fluid to administer its protein. We are afraid of fluid in these cases.

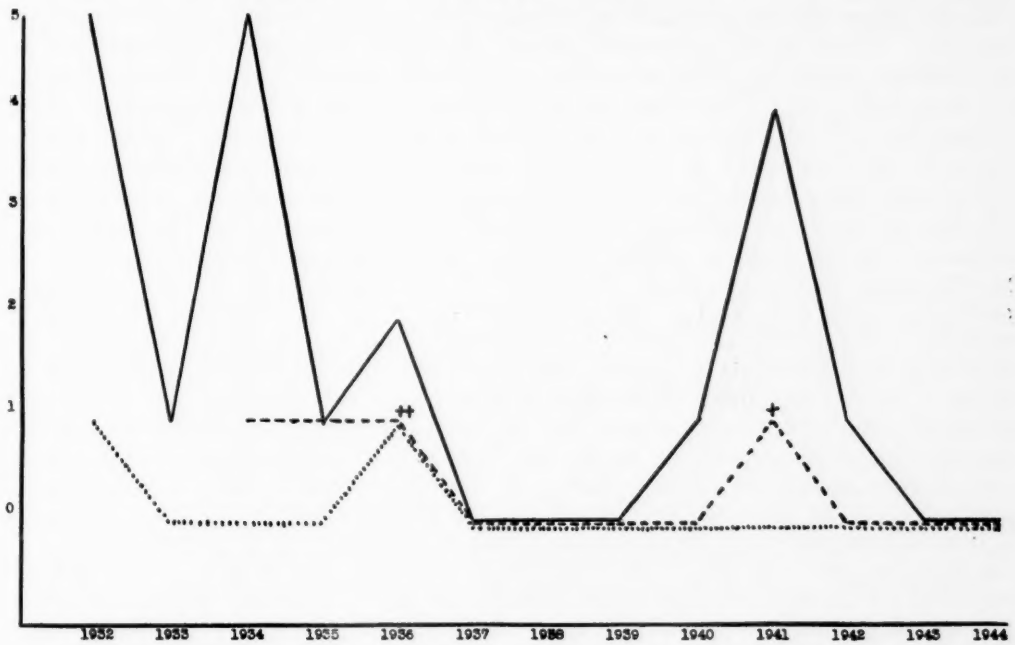

Fig. 1.—Incidence of eclampsia and eclamptic mortality.
—— Total cases of eclampsia.
---- Patients treated antepartum by dehydration and fluid balance (begun June, 1934).
.... Deaths from eclampsia.
+ Postpartum eclampsia due to accidental discontinuance of treatment.
++ Doctor "became anxious." Discontinued treatment. Patient died.

Results

It is interesting to note that in these 325 cases there were only two that reached the delivery stage and the delivery room with edema; one was a chronic nephritic, and the other a cardiac patient. There were in the whole group only 32 cases that showed even the slightest transient edema throughout the antenatal period. It might be well here to state that we believe the onset of "toxemia" is concerned with improper water metabolism. The general statistics of the hosptial, as shown in the accompanying chart (Fig. 1), show conclusively the effect of this effort in the reduction of true, pure "toxemia." It shows also the total abolition of eclampsia since 1936, where this routine has been used. The only exception was a postpartum eclampsia in which

restriction was accidentally discontinued on delivery of the patient. There has not been a death from eclampsia since 1936, and only one since 1933 and, in this instance the treatment was not used. Likewise, there were in this group of 325, 27 cases that exhibited a transient blood pressure rise of 20 mm. or more, five of these being over 30 mm. and one over 40 mm., but none of these reached the hospital with anything but a normal reading. These transient rises would be ordinarily disregarded, but they were the nearest approach to pre-eclampsia that was observed. The absence of albuminuria was remarkable. In these cases we were able to find only nine specimens that showed an appreciable amount of albumin.

But there were other advantages: the remarkably low incidence of abnormal presentation; the abnormally low incidence of primary cesarean section for bony and soft tissue dystocia; the stillbirth record; and the marked diminution in length of labor. Taking them in order: posterior positions occurred, but did not cause the dystocia that we would expect in the type of patient that was handled. There were only twelve forceps rotations in primaparas, and two in multiparas; eleven mid-forceps, all in primiparas; there were no versions, except for a second twin. There were six breech presentations each for multiparas and primiparas. There was only one cesarean section for dystocia. There was a total of eleven cesarean sections. Four were in primiparas: the first for very severe rheumatic heart disease, the second for a mole with a term child causing profuse hemorrhage, the third for placenta previa centralis, and the fourth for dystocia. There were no primary sections in multiparas, but there were seven repeat sections in this group. This gave us an incidence of primary cesarean section of 1 in 81.2, and a rate of 1.2 per cent; and an incidence of cesarean section for dystocia of 1 in 325, or .003 per cent. This relatively low rate of abnormal delivery was in keeping with the ease with which these patients had their babies. Practically all of these patients were delivered by low forceps or outlet forceps. For example, only 16 primiparas spontaneously delivered, mostly because I did not have time to do anythnig else, and 94 multiparas delivered spontaneously for the same reason. One hundred seven primiparas and 59 multiparas were delivered by low or outlet forceps. There were five stillbirths, a rate of 1.53 per cent. This compares very favorably with the stillbirth rate of the Chicago Lying-in Hospital,[1] which was reported as 2.14 per cent, and that reported by Kernis[1] of 5.2 per cent, and that reported by Sloan[1] of 4.4 per cent; but of course, these were in a larger series of cases. These five stillbirths were not attributable to delivery. One was a mole with a living child that died just before cesarean section; one was a macerated twin; the third was another macerated child at term with the cord tightly twisted about its neck; the fourth was an anencephalic monster; and the fifth was a fetus with polycystic kidneys. There were no fetal deaths from prolonged or difficult labor. There were two neonatal deaths: two prematures; one following a cesarean section for central placenta previa, and one following an abruptio placenta with massive external hemorrhage treated conservatively.

It is important to note that the average age of these patients is higher than normal, being 29.4 years, and the problems arising from just the fact of the age have been minimized, it is believed, by this routine.

The effect of this routine on the length of labor and the other factors that are problems in the ordinary labor cases may now be considered. The average age of these patients was 29.41 years. The 159 primiparas averaged 27.47 years, and the 166 multiparas 31.36 years. This was definitely not a young group. There were, for example, 53 primiparas and 114 multiparas over 30 years of age. That is exactly one-third of the primiparas, and exactly two-thirds of the

multiparas over 30 years, and 51 per cent of the whole 325 over 30 years. The younger patients were the hardest to handle because of previous lack of care. Many of them had reached "blimp" proportions when we saw them. The overall gain of all patients was only 14.9 pounds, the primiparas averaging 15.4 and the multiparas averaging 14.3 pounds. The average labor of the group was 6 hours and 17 minutes, primiparas being 7.19 and the multiparas 5.15 hours. This short duration of labor was obtained in spite of six cases of cervical dystocia and eight cases of uterine inertia. Presented again, the average weight gain for 325 cases was only 14.9 pounds, the average age was 29.4 years, and yet the average length of labor was only 6 hours and 17 minutes. This was consistent with the facts of the first paragraph, namely, that it is possible to have shortened labors as a result of satisfactory food control, diet, and fluid balance, and exercise.

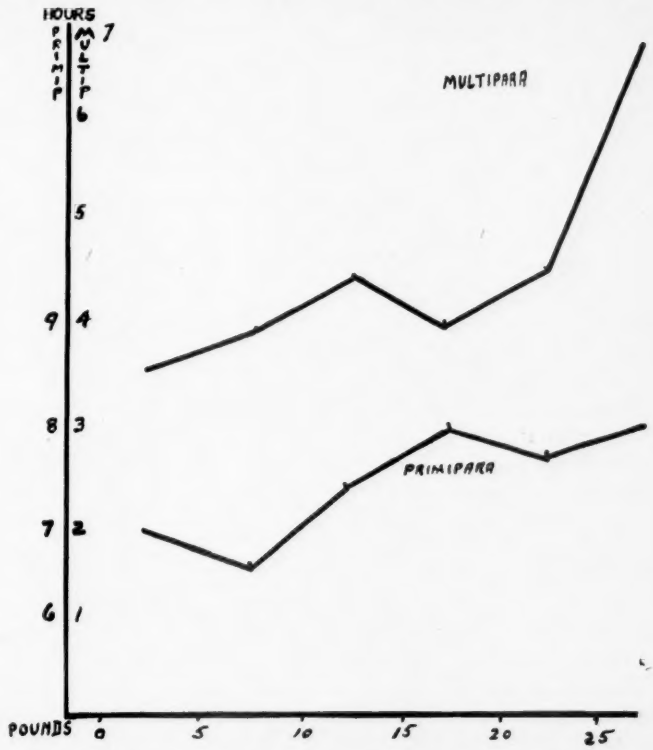

Fig. 2.—Effect of weight gain, diet, and fluid balance on length of labor.

The babies in this series were all average in size. There was no baby that was abnormally small and there were none extremely large, but, in many instances, the largest babies were born to mothers who made no gain or a minimal gain. In one instance, a very stout woman who gained no weight delivered a 9-pound baby, and, from these records, we can only corroborate the work of previous investigators who have shown conclusively that there is no reduction generally in the weight of the baby due to restriction in diet. It is true, of course, that there were no extremely heavy babies, but there were some solid, large children. There were no fetal deaths from dystocia. There was no toxemia and no difficult deliveries, except in three cases of cervical dystocia which were delivered under caudal anesthesia. Yet, to accomplish this, all that seems to be necessary is to use some self-evident facts, faithfully and diligently, some outmoded exercises, and, unfortunately for the obstetrician, a great amount of tough perserverance.

In Fig. 2, the relationship between weight gain and length of labor is graphically presented. There is a definite lengthening of labor as the weight increases, but the labors were all fairly short.

In Fig. 3, the effect of weight gain on dystocia is shown. The higher rate in the 0- to 5-pound group, and in the 5- to 10-pound group was expected by the difficult type of case in these groups. The dotted line shows only a trend, as the cases were too few.

In Fig. 4, the effect of weight gain on an arbitrary standard of toxemia is demonstrated. The curve is the same as in Figs. 2 and 3, and is presented for what it is worth.

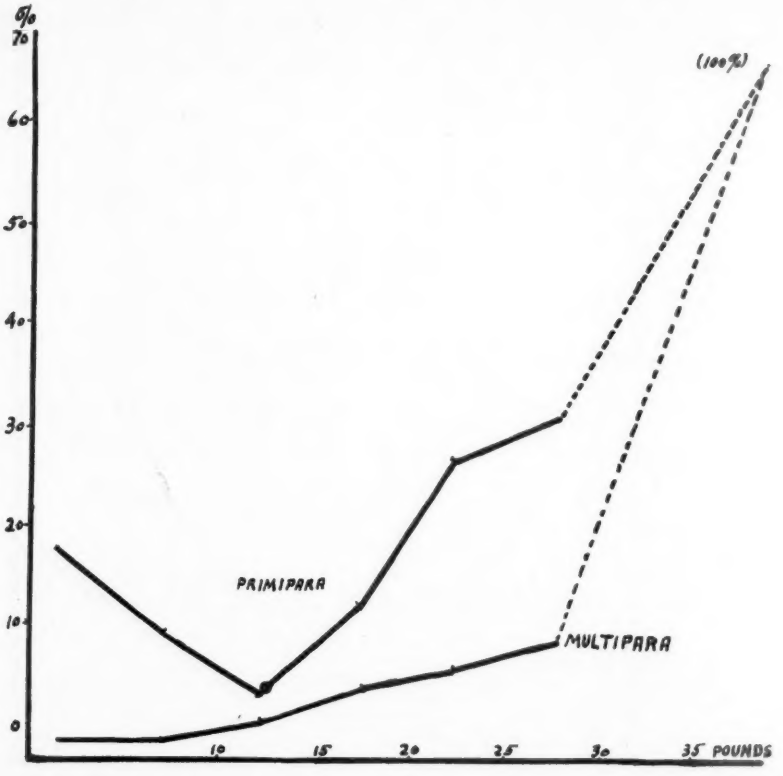

Fig. 3.—Effect of weight gain, diet, and fluid balance on dystocia.

For further observation, in more detail, the gains have been divided into groups for convenience. They are of approximately 5 pounds each. The first chart, Table I, shows the grains from 0 to 4 pounds, plus the cases which lost weight. As a matter of fact, one patient lost 32 pounds. This group is the difficult group. The primiparas here averaged over 28 years of age, 16 of the 19 being over 25 years, and 13 of them over 26 years. They were the obese patients, the ones with abnormal pelves, the ones with whom we ordinarily would expect trouble. It includes some cardiacs, one a very bad cardiac; and as a result of the regimen, the average labor was only 6.9 hours, and the weight was kept to 1.7 pounds average (the 32-pound loss in a bad cardiac was not included). In spite of this, the incidence of abnormalities was fairly high, but when we consider the type of case that was handled in this group, the results, I feel, were good. The only primary cesarean section for dystocia in the whole group occurred here. It was necessary, for the patient was a 26-year-old, very

obese, pituitary type woman, having a cephalopelvic disproportion due to a very definite android pelvis. She was sectioned after a six-hour test of labor. Peculiarly, the four primary cesareans, as previously described, occurred here. None of the other three were due to dystocia, as previously noted. There were three midforceps rotations, and only one patient showed any transient edema. The multiparas fared even better, with a 29-year average and an average gain of 3.35 pounds. The average length of labor for this group, all of whom were over 25 years of age, was 3.8 hours; none developed even a transient edema; and there was not one abnormal delivery.

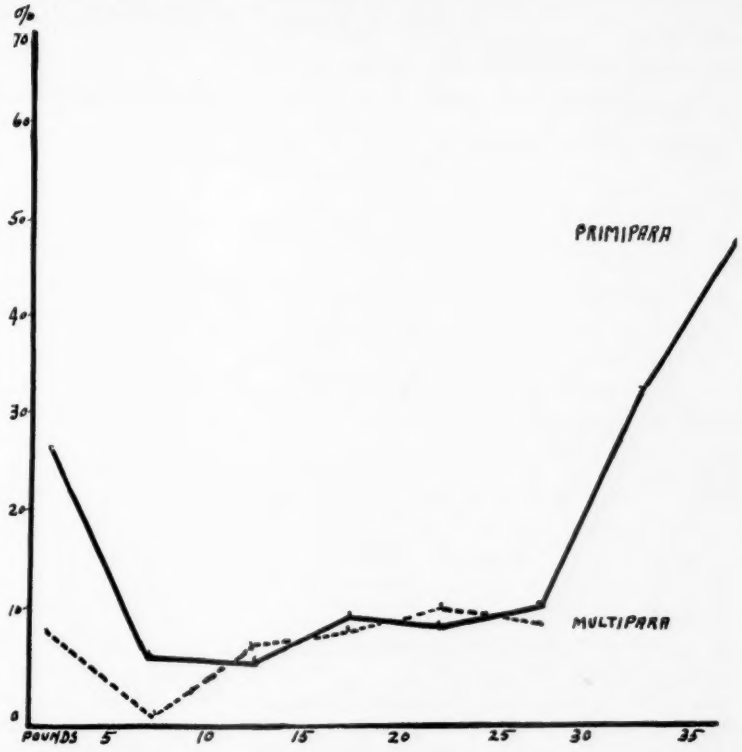

Fig. 4.—Effect of weight gain, diet, and fluid balance on blood pressure. Transient rise of 20 mm. or more.

Considering the second group who gained 5 to 9 pounds, there were 38 patients. These, too, contained the difficult type of case that we are anxious to control thoroughly. This primiparous group was also over 28 years, had an average gain of 8 pounds, and yet had a labor rate of only 6.6 hours. There was only one midforceps delivery in this group, none of them showed any evidence of a toxic state except two that presented a very transient edema, and one that showed a temporary rise of 20 mm. in blood pressure. The multiparas did even better, showing no complications whatsoever. The group gaining 10 to 14 pounds numbered 93 (Table I); the primiparas were well over 29 years' average, showing an average gain of 12.6 pounds and an average labor of 7.4 hours. There was only one midforceps delivery in this group and two forceps rotations, but we began to show a slight increase in tendency to complications because both the multiparas and primiparas together included six cases with a temporary blood pressure rise of over 20 mm.

In the 15- to 19-pound gain group we had 87 patients (Table I). The age is a little lower, 26.3 years for the primiparas and 30.68 for the multiparas.

TABLE I. TABULATION OF CASES IN GROUPS

PRIMIPARA		MULTIPARA
Group Gaining Less Than 1 to 4 lbs. (31 cases)		
19	Total number	12
28.6	Average age	29.66
1.67	Average weight gain	3.35
6.9	Average length of labor	3.8

1. A difficult group: includes the very obese, the pituitary cases, obvious obstetric difficulties, and some cardiovascular diseases.
2. Results were good. Dystocia evidenced by only three midforceps rotations and 1 cesarean section.
3. However, all primary sections occurred in this group.
4. No evidence of severe toxic state. One in each group showed a transient blood pressure rise of 20 mm.

Group Gaining 5 to 9 lbs. (38 cases)		
17	Total number	21
28.2	Average age	33.3
8	Average weight gain	8.13
6.6	Average length of labor	3.98
	Results	
0	Cesareans	1 (repeat)
1	Midforceps	0
2	Transient edema	0
0	Blood pressure (trans. rise of 20 mm.)	0
Group Gaining 10 to 14 lbs. (93 cases)		
37	Total number	56
29.7	Average age	32.0
12.6	Average weight gain	12.32
7.4	Average length of labor	4.38
	Results	
0	Cesareans	2 (repeat)
1	Midforceps	0
2	Forceps rotation	1
2	Total blood pressure rise 20 mm. plus	4
Group Gaining 15 to 19 lbs. (87 cases)		
39	Total number	48
26.3	Average age	30.68
17.4	Average weight gain	17.06
7.94	Average length of labor	4.05
	Results	
0	Cesareans	3 (repeat)
1	Midforceps	1
2	Midforceps rotation	0
4	Transient edema	2
4	Transient blood pressure rise 20 mm. plus	4
Group Gaining 20 to 24 lbs. (48 cases)		
31	Total number	17
25.93	Average age	30.11
22.47	Average weight gain	21.73
7.77	Average length of labor	4.37
	Results	
0	Cesareans	1 (repeat)
4	Forceps rotation	0
2	Midforceps	0
5	Transient edema	1
3	Transient blood pressure rise 20 mm. plus	2

PRIMIPARA		MULTIPARA
Group gaining 25 to 29 lbs. (19 cases)		
9	Total number	10
25.66	Average age	29.5
26.47	Average weight gain	25.82
8	Average length of labor	7.13 plus
	Results	
0	Cesareans	0
2	Midforceps	1
0	Forceps rotation	0
3	Transient edema	2
1	Transient blood pressure rise 20 mm. plus	1
Group Gaining 35 to 39 lbs. (5 cases)		
21.5	Average age	26
35.87	Average weight gain	35.25
7	Average length of labor	8.5

All cases became difficult.
All met some dystocia.
All required dehydration.
All had temporary severe blood pressure rises.
All primiparas were under 26 years of age.

Their average weight gain was 17.4 pounds in primiparas and 17.06 pounds in multiparas, respectively, and their labor was a little longer, averaging 7.94 and 4.05 hours. Here we met a slight and definite increase in complications. In this group there were three midforceps rotations, six that showed a transient edema, and eight that had a temporary rise of blood pressure over 20 mm. We have had to take this low standard because it was the only point at which we could attempt to evaluate the blood pressure changes. It is realized, of course, that a 20 or 30 mm. change in blood pressure transiently is not regarded as of any particular importance, but as there was not any great change in any of these patients, it has been used as a standard for what it is worth.

In the succeeding group showing a (Table I) 20- to 24-pound gain, the number decreases to 48. The average age for primiparas decreases to 25.93 years, and their weight gain is 22.47 pounds. The multiparas gained 21.73 pounds, and the length of labor is about the same as the previous group, 7.77 and 4.37 hours. We notice in our evaluation of this group that four of these primiparas required forceps rotation; two, midforceps delivery; five showed a very transient edema; and three of them a blood pressure rise of 20 mm. or more. The multiparas did better in an absence of dystocia, but their tendency to toxic state was proportionately even worse. The percentage in Table II is much higher than in the previous group.

The 25- to 29-pound gain group is reduced to a total of 19, so that I have not been able to include fairly these in the graphs, but, nevertheless, the labor in what we did have was very markedly lengthened and the complications proportionately increased.

The last group, totalling only four, is hardly a fair estimate of what occurs, but it is significant that this group with an average gain for the primiparas of 35.87 pounds and the multiparas of 35.25 pounds were the most difficult. Every one of them had a very definite blood pressure rise and some obstetric and dystocial difficulty. It is also peculiar that in the last two groups, totalling eight patients all were under 26 years of age. Evidently, their relatively short labors of 7 hours and 8.5 hours, respectively, were somewhat assisted by their youth.

TABLE II. RECAPITULATION

WEIGHT GAINS BY GROUPS (POUNDS)		TOTAL NUMBER	LENGTH OF LABOR (HOURS)	DYSTOCIA	BLOOD PRESSURE VARIATION 20 MM. OR OVER
0- 4	P	19	6.9	4 or 21%	1 or 20.8%
	M	12	3.8	0 or 0%	1 or 8.3%
5- 9	P	17	6.6	2 or 11.7%	1 or 5.8%
	M	21	3.98	0 or 0%	
10-14	P	37	7.4	2 or 5.4%	2 or 5.4%
	M	56	4.38	1 or 1.7%	4 or 7.1%
15-19	P	39	7.94	5 or 12.8%	4 or 10.2%
	M	48	4.05	2 or 4.1%	4 or 8.3%
20-24	P	31	7.77	9 or 29.2%	3 or 9.6%
	M	17	4.37	1 or 5.8%	2 or 11.7%
25-29	P	9	8.00	3 or 33.3%	1 or 11.1%
	M	10	7.13	1 or 10%	1 or 10%
30-34	P	3	5.91	0	1 or 33.3%
	M	1	5.00	0	-
35-39	P	4	7.1	4 or 100%	2 or 50%
	M	1	8.5	1 or 100%	-

Summary and Conclusions

From these figures, of course, we can draw no definite conclusions, we can just infer with a definite question mark as to what exactly is the controlling factor and why it is that these labors were so short. When we realize that the average labor as given by DeLee[1] is 18 hours for primiparas, 12½ for multiparas, and 27 hours for elderly primiparas, and by Beck[7] as 18 hours for primiparas and 12 hours for multiparas, and yet ours are so much shorter, we begin to wonder if the regimen as described is not responsible for this happy situation. This means definite lessening of pain; less sedation than in the prolonged labor; less trauma to the baby; less supportive treatment; and less effort for the obstetrician and hospital personnel. In many of these patients, the progress is so rapid that sedation is not possible, except nitrous-oxide in the latter part of the second stage. Delivery in these cases was in no way forced. These accouchments were all handled conservatively, the only "radical" thing being outlet forceps and episiotomy. No patient was allowed to stay in labor unduly long, but no case was delivered before the proper time. All cases were delivered under gas-oxygen or gas-oxygen-ether anesthesia, except the cervical dystocias which were given a single injection caudal or low spinal anesthetic and delivery completed in each instance with ease. The fact of lessened analgesia gives us a very satisfying incidence of asphyxia neonatorum.

These statistics, under this plan of prenatal care, are presented merely as an interesting observation. We realize, of course, that many men do use many parts of this treatment for the established "toxic," but there are many others who totally ignore what we consider the earliest evidences of toxemia, namely, fluid retention. It is strongly felt that continued marked retention invites disaster, and neglect of the factors here under discussion invite obstetric difficulties that require time and worry and difficult procedures to overcome.

We have presented 325 cases in which, in conjunction with a regimen previously described, the length of labor has been markedly decreased; the incidence of dystocia markedly lessened; and any real toxic state totally absent, except in one case of chronic nephritis which we do not believe is in any way influenced by this type of regimen. This case was induced and is the only induction in the series. Three severe cases of hypertensive cardiovascular disease were decidedly improved and were uneventfully delivered. It is believed that these results can be reproduced at will in the patient who is willing to cooperate, if a high protein, high vitamin, and low carbohydrate diet is instituted, a very definite amount of exercise is included, and the fluid balance is properly maintained. There was no mortality.

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THERAPEUTIC ABORTION IN A GENERAL HOSPITAL*

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DURING the past few years, I have been called upon to assist officers of the Drug Division of the United States Food and Drug Administration in the preparation of evidence for the institution of legal action against the manufacturers and distributors of abortifacient pastes.[1] It was essential to supply testimony which would emphasize the many dangers involved in the use of such pastes, and which would refute the various claims made on the printed labels. In one instance, it was necessary to offer statistical data to controvert the statement that therapeutic abortions are frequently indicated, therefore all cases on which a therapeutic abortion had been done at the New York Post-Graduate Hospital during a ten-year period were reviewed (Table I).

TABLE I. THERAPEUTIC ABORTIONS DURING A TEN-YEAR PERIOD AT THE NEW YORK POST-GRADUATE HOSPITAL

By the Director of the Gynecological Service	34
By other gynecologists	39
By general surgeons	11
Total	84

It is perhaps natural that the majority of patients should gravitate to the Director of the Gynecological Service, who performed about 40 per cent of the abortions done. Before the publication of a recent paper by Cosgrove and Carter,[2] in which only four interruptions of pregnancies were reported in 67,000 deliveries at the Margaret Hague Maternity Hospital, the number of our cases, 84, and the incidence of our therapeutic abortions seemed creditably low. Both the extremely small number of induced abortions and the astonishingly few indications for the termination of pregnancies in the Margaret Hague Maternity came as a surprise to one who has conscientiously tried to regulate therapeutic abortions under his control to those conditions for which they are regarded as justified for the protection and prolongation of the mother's life. In one of Cosgrove's and Carter's cases, abortion was done for hyperemesis gravidarum, and three others were for hypertension and nephritis. Realizing that the Margaret Hague Maternity is but an obstetric unit adjoining the Jersey City Medical Center, it might be assumed that the largest percentage of therapeutic abortions were performed in either the gynecologic or general surgical departments, or both, but in a personal communication Doctor Cosgrove stated that this was not so. Despite making generous allowances for ultraconservatism, the discrepancy between the statistics of a strictly maternity hospital and a general

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hospital is so startling that it seemed desirable to scrutinize in some detail the same 84 cases at the New York Post-Graduate Hospital which I had utilized previously for expert testimony in the Federal Court.

In selecting the material from which to compile this statistical evidence, all pediatric, orthopedic, dermatologic, and male patients were excluded, thus limiting the basis for the figures used to adult females (Table II).

It is apparent that, of the 84 induced abortions, 55, or more than one-half, were ward cases, which indicates that most of them were done on patients of low income levels.

TABLE II

Gynecologic and female surgical hospital admissions		29,516
Therapeutic abortions	84	
New female adult admissions to all clinics exclusive of the Dermatological Clinic		172,552
Therapeutic abortions—ward cases	55	

TABLE III

Gynecologic admissions to hospital		4,871
Therapeutic abortions by the Director of Service	34	
Therapeutic abortions by other gynecologists	39	
Total	73	
Per cent of therapeutic abortions in gynecologic hospital admissions (including 18 private patients)		1.49
Surgical admissions to hospital (female)		24,645
Therapeutic abortions by general surgeons (all private patients)	11	
Per cent of therapeutic abortions done on the surgical service by general surgeons		0.04
Per cent of therapeutic abortions in 25,516 adult female hospital admissions		0.28

Table III shows that 11 abortions were done by general surgeons and 18 by gynecologists, a total of 29, on semiprivate and private room patients. However, a hospital rule pertaining to therapeutic abortions has been in effect for the past few years, which applies to all patients, regardless of their hospital status, and every operator, and reads as follows: "In cases of therapeutic abortions the indications must be indorsed in writing by two members of the Attending Staff of the New York Post-Graduate Hospital; one shall be the operating surgeon, and one a physician specializing in the condition necessitating the procedure, or a recognized specialist whose qualifications are acceptable to the Superintendent of the Hospital." It must be admitted that, while the majority of these therapeutic abortions were done to preserve the mother's health, to prolong her life, and to prevent serious and permanent injury, under the direction of at least two licensed practitioners of medicine the life of the mother was not always threatened imminently.

The inherent risk to the mother involved in a surgically clean and thorough therapeutic abortion, performed by a capable pelvic surgeon in a modern hospital operating room, barring surgical accidents, is *nil*. Seventy-four of our patients were operated on between the third and twelfth weeks of pregnancy, and the other ten between the thirteenth and eighteenth weeks. The average operating time was sixteen minutes, and there was no maternal mortality in

the 84 cases. If it is the duty of the profession to save and conserve human life, and if as the old English common law holds, the unborn child, prior to quickening, has no entity, then the physician's conscience and judgment must dictate which is entitled to greater consideration: the future life and health of the mother or the possible future life of a still nonviable fetus. It may be conceded that the nonviable fetus is entitled to the protection of its life potentialities in normal cases, but when such conservatism seriously jeopardizes the life and health of an already living human being, it is not unnatural that the laws of most States should recognize that licensed physicians must accept certain responsibilities, and establish their own ethical standards on a strictly medical basis. On the other hand, social problems and economic considerations should never influence a decision to the slightest degree.

There is a great difference between the removal of all deterrents to the practice of therapeutic abortions and the interruption of pregnancy for serious physical ailments under proper, honest, and strictly controlled medical supervision. I would question the implication that a conscientious and well-qualified obstetrician or gynecologist should be stigmatized as a mere mechanic to carry out the advice of a specialist in another field, just because he may rely to a certain extent on the latter's experience and opinion. The decision in each individual case should rest upon the combined judgment of at least two physicians of wide experience, but it is not unnatural that the opinion of the one who is really expert in the treatment of the particular condition that constitutes the reason for the interference should carry considerable weight. The indications for the termination of pregnancy in our 84 cases are classified in Table IV.

TABLE IV. INDICATIONS FOR THERAPEUTIC ABORTION

Cardiovascular disease	20
Psychoneurological diseases	14
Renal disease	12
Hyperthyroidism	9
Tuberculosis	8
Persistent hyperemesis gravidarum	3
Miscellaneous	18
Total	84

All of our patients were white women, the youngest being 19 years and the oldest 43 years of age. Thirteen patients had had one or more previous therapeutic abortions. Eight patients had additional surgical procedures done simultaneously with the curettage or vaginal hysterotomy. In only 15 instances was the abortion done for the patient's first pregnancy, the other 69 all being multigravidas.

Cardiovascular Disease.—In fifteen of the twenty cases in which cardiovascular disease was the indication for therapeutic abortion (Table V), mitral stenosis with insufficiency was the predominating feature, and all were classified as 2B or more severe by the cardiologist. One of these patients had a history of several previous episodes of decompensation, two had a concomitant aortic insufficiency with marked hypertrophy, one had coexisting multiple fibroids, and another a large ovarian cyst. Two patients had serious hypertensive cardiovascular disease, and one of them developed a progressive hyperemesis gravid-

TABLE V

Mitral stenosis	15
Hypertensive cardiovascular disease	2
Congenital heart disease	1
Heart disease with multiple complications	1
Unclassified	1
Total	20

arum, which failed to improve under appropriate therapy. One patient with congenital heart disease was classified as 2B, and another had marked cardiac arrhythmia with premature ventricular contractions, thyroid dysfunction, cholecystitis, and secondary anemia. The details on the chart of one patient, aborted by a senior member of the attending staff, now deceased and whose private records are not available for review, are incomplete, so that this case cannot be correctly evaluated. Ten of the twenty patients originated in the cardiac clinic, where all patients are seen by not one cardiologist, but several.

TABLE VI. PSYCHONEUROLOGICAL DISEASE

Dementia precox	3
Maniac depressive psychosis	3
Epilepsy	4
Neurosyphilis	2
Malignant brain tumor	1
Muscular dystrophy	1
Total	14

Psychoneurological Diseases.—The six cases of mental disease and the four epileptics (Table VI) had been diagnosed as such long before the interruption of pregnancy, and all fourteen patients were referred to the gynecologic service by a senior attending psychiatrist, neurologist, or neurosurgeon. One patient with neurosyphilis had bilateral optic atrophy and complete blindness. Another after two years of treatment, was still Wassermann fast and showed signs of mental deterioration. The patient with the malignant brain tumor had also had a previous resection of the eighth cranial nerve.

TABLE VII. RENAL DISEASE

Chronic glomerular nephritis	6
Solitary kidney	3
Nephrolithiasis	2
Pyelonephritis	1
Total	12

Renal Disease.—The six cases of glomerular nephritis (Table VII) were all proved by laboratory tests and were seen by consulting internists and urologists. One had an associated aortic stenosis, another had an independent hypertensive cardiovascular disease, and another had had four previous toxemias of pregnancy. One patient with a solitary kidney had the other one removed three years previously for renal tuberculosis, and when referred for the abortion still had active pulmonary tuberculosis and a tuberculous colitis. Another, aged 31 years, who had one living child, had had a nephrectomy for a large hydronephrosis two years previously, and suddenly developed acute urinary obstruction from a ureteral stricture on the other side. The third, aged 34 years, who had three living children, had a nephrectomy for a contracted infected kidney

secondary to nephrolithiasis, and the remaining kidney showed evidence of marked chronic nephritis, as indicated by the blood chemistry, urine, and renal function tests. One patient with nephrolithiasis was transferred four days after the abortion to the urological service for pyelotomy. The other one had bilateral renal stones with pyonephrosis. The patient with bilateral pyelonephritis was 37 years old, a para ii, and became progressively worse instead of better despite prolonged treatment in the urological clinic.

Tuberculosis.—All eight patients, aborted because of tuberculosis, had active and far-advanced pulmonary tuberculosis, proved by x-ray examination, and five of them had grave complications (Table VIII).

TABLE VIII. TUBERCULOSIS

Advanced pulmonary tuberculosis	3
with tuberculous rhinitis, bursitis, and urogenital tuberculosis	1
with empyema	1
with pneumothorax	1
with previous thoracoplasty	1
with duodenal ulcer and cholecystitis	1
Total	8

Thyroid Disease.—Therapeutic abortion was indicated in nine cases of thyroid disease. The patients classified as having severe hyperthyroidism had basal metabolic rates of plus 42, 32, and 24, respectively, and the second one had coexisting hypertensive cardiovascular disease, with a blood pressure of 190/112. One of the five patients with persistent hyperthyroidism after thyroidectomy had been operated upon twice before, and when she entered the hospital for a third thyroidectomy was found to be pregnant. The patient with carcinoma of the thyroid had had a thyroidectomy two years previously, which was followed one year later by a radical neck dissection for recurrent carcinoma in the cervical lymph nodes.

TABLE IX. THYROID DISEASE

Severe hyperthyroidism	3
Persistent hyperthyroidism after previous thyroidectomy	5
Carcinoma	1
Total	9

TABLE X

Persistent hyperemesis gravidarum	3

Two patients were aborted for uncontrollable hyperemesis gravidarum, but one had to be aborted a second time within two years (Table X). She was a gravida ii, with a history of a severe toxemia of pregnancy before a delivery two years before, and was treated in the hospital for thirteen days, when she improved enough to be discharged. One week later she was readmitted with severe vomiting, a rise in blood nitrogen and uric acid, plus 3 acetone, plus 2 diacetic acid, and albuminuria, and was aborted after twelve days of ineffectual treatment. One year later the uterus was emptied again for the same reasons. The second patient, a gravida i, para i, had had a difficult labor, and entered the hospital with a severe hyperemesis, which became progressively worse after five days of treatment, complicated by a maniac depressive psychosis and suicidal tendencies.

TABLE XI. MISCELLANEOUS

Banti's disease with splenectomy	1
Maternal blood dyscrasia with three previous abnormal babies	1
Impetigo herpetiformis	1
Acute rheumatoid arthritis	1
Severe uncontrollable diabetes	2
Chronic interstitial hepatitis	1
Severe constitutional and metabolic impairment	1
Postpartum psychosis after previous cesarean section for contracted pelvis	1
Surgical complications	
Previous plastic repairs	2
Pelvic peritonitis and ovarian cyst	2
Rectovaginal fistula and hyperthyroidism	1
Therapeutic errors	
Malignancy of uterus	1
Previous placenta previa	1
Phlebitis	1
Lumbosacral pathology	1
Total	18

The patient with Banti's disease had a splenectomy and biopsy from the liver four years previously. She had recurring leucocytosis, fever, and gastric hemorrhages.

A gravida iii, suffering from a recurring secondary anemia, had been delivered by the same physician of three babies, all of whom were apparently born with erythroblastosis, before the importance of the Rh blood factor was appreciated by obstetricians. The last one also had a marked jaundice and only 27 per cent hemoglobin, requiring three transfusions. Despite liver and iron therapy the patient was still very anemic and was aborted at the seventh week after she became pregnant again.

The patient with impetigo herpetiformis was referred by Doctor George Miller Mac Kee, after having been seen by all the senior dermatologists at the Post-Graduate Hospital. Doctor Mac Kee is my authority for the statement that impetigo herpetiformis is an extremely rare disease of mysterious origin, occurring only in pregnant women. Not more than twenty-five cases have been reported in the literature, and only three of them were in this country. The only known treatment of any avail is prompt abortion, and, notwithstanding the interference, about 85 per cent of the patients die. Our patient improved enough to leave the hospital six months after the abortion, but died of the disease about a year later.

The patient with acute rheumatoid arthritis was showing progressive advancement of the disease with erosions of the bones and a very high blood sedimentation rate, and was under treatment with gold salts.

Both diabetic patients had been under treatment for several years, and in both instances it was impossible to get the urine sugar or acetone free. The first one was 41 years of age and had three living children. The second had eclampsia with a delivery five years previously, and two weeks later had to have a laparotomy, which was followed by acidosis and coma, with a blood carbon dioxide combining power of 27. All blood sugar readings for five years had been over 200. At the time of her admission for therapeutic abortion the urine showed sugar 4 plus, acetone 3 plus, and diacetic acid 2 plus, and the blood carbon dioxide combining power was 35.

The patient with hepatitis had four pregnancies in the previous five years. She had had a recent cholecystectomy and was seen in consultation with both a surgeon and an internist.

A patient in a serious physical condition, with anemia and severe constitutional and metabolic impairment, who had had three previous pregnancies, was aborted after consultation with an internist and another gynecologist.

A 37-year-old gravida ii, who developed a severe anemia with each pregnancy, both of which were terminated by cesarean section for contracted pelvis, developed a postpartum psychosis after the last one, and became pregnant again before it cleared up.

Two patients were aborted because of extensive plastic repairs. The first one was a gravida iii, who had developed a rectovaginal fistula above a complete perineal laceration. Two previous attempts at repair had been made elsewhere before I operated on her successfully. Two years later she was aborted. The other woman was 40 years old, a gravida ii, and had also had an extensive plastic repair for a complete laceration, with amputation of the cervix. It is true that both of these patients might have been allowed to go to term and be delivered by cesarean section, but they both had living children, and it seemed unwise to risk another breakdown incidental to the circulatory changes during the last weeks of pregnancy.

Two patients were aborted incidentally during operations for extensive pelvic agglutinations and large ovarian cysts. The first one had three children, and had had a previous laparotomy. The third delivery, eighteen months before, had been followed by acute pelvic peritonitis. Since then she had suffered from intense pelvic pain, which for the last two months had become almost unbearable. The abortion was done before a technically difficult laparotomy. The second patient was much like the first one, except that she had had two previous laparotomies, including some sort of uterine fixation. Evacuation of the products of conception was difficult, and her pelvic adhesions and ovarian cyst had caused an intestinal obstruction.

A patient with a fresh rectovaginal fistula and third degree perineal tear and hyperthyroidism was aborted at the time of the plastic repair, prior to her thyroidectomy.

There were four cases which may be charitably designated as therapeutic errors. They were all performed before the days when formal consultation was made mandatory. The first patient was 31 years of age, and a gravida iii. She had continuous bleeding after the birth of her last baby six months previously. From this history, one might assume that the uterus was subinvoluted or harbored some shreds of placenta. However, one of the senior general surgeons sent the patient into the hospital with a diagnosis of malignancy of the uterus, although he posted her operation as "therapeutic abortion, curettage, and frozen section," so he must have suspected the presence of the existing pregnancy. The pathologic report on the "curettage" showed a "fetus of the male sex and placenta." The logic, ideas, and procedures involved in this case are beyond my comprehension.

In a second case, also done by a general surgeon, the indication for the abortion was given as "prophylaxis as a health procedure because of nervousness, after a severe toxemia and placenta previa with her first pregnancy."

In a third case, also done by a general surgeon, the only indication seemed to be a long-standing phlebitis of the leg with swelling, cyanosis, and varicose veins.

In a fourth case, an abortion was done by a member of the gynecologic staff on the recommendation of an orthopedist, because of lumbosacral bone pathology. He should have known better.

Occasional professional lapses as exemplified by the records of these last four cases are no longer possible, and have not been for some time. Even before the adoption of the existing hospital rules pertaining to therapeutic abortions, practically all candidates for abortion were seen not only by one con-

sultant, but by several. The review of the charts utilized in the preparation of this paper has been quite enlightening, and although some errors on the side of liberality may have been made, I believe that most of the patients were treated correctly.

I am indebted to Doctor Henry P. Wager for his help in reviewing the case records and compiling much of the data therefrom.

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Discussion

DR. CHAS. GORDON HEYD (by invitation).—The occasions upon which a goiter surgeon seeks aid and counsel from the Gynecological Department for the purpose of inducing a therapeutic abortion are fortunately very few.

Continuing and persistent hyperthyroidism is a very disabling condition and occasionally lethal. The advent of pregnancy in an individual with hyperthyroidism adds to the basal metabolism of the mother the additional increment of the basal metabolism of the child. This additional basal metabolic rate of the child may be sufficient to induce an acute thyroid crisis with death. Therefore, there are two types of individuals with hyperthyroidism that warrant a consideration of the question of the artificial termination of pregnancy: (a) the patient already pregnant, with an hyperthyroidism; and (b) the postoperative hyperthyroid patient who becomes pregnant. In the first group we have come to certain definite conclusions. If the patient enters the hospital pregnant and with a well-defined hyperthyroidism we do not request an interruption of pregnancy, as a therapeutic abortion in a patient with a continuing and high hyperthyroidism may quite readily project that patient into an acute hyperthyroid crisis. After a short preoperative preparation we perform a subtotal thyroid resection irrespective of the pregnancy, for, with the amelioration of the hyperthyroidism by surgical intervention, the pregnancy may be allowed to continue to term. The risks inherent in thyroid surgery in a pregnant woman are no greater, if not less, than the dangers attendant on an interruption of her pregnancy. It is a rather interesting thing that spontaneous miscarriage following a thyroid resection in the pregnant woman is unusually rare and has occurred in our hands in only eleven consecutive cases.

In the second group, the postoperative thyroid patient who becomes pregnant, we have an entirely different problem. Here, we have a patient who has recently had a subtotal resection of the thyroid gland for hyperthyroidism. We believe that her future will be seriously endangered if she becomes pregnant within a year to eighteen months after her thyroid surgery, preferably not until two years have intervened between the thyroid surgery and her pregnancy. We are of the opinion that the continuation of pregnancy in this group carries with it a high incidence of recurrence of hyperthyroidism, one that is apt to be of more severe type than the original condition and inimical to the life and well-being of the mother.

Therefore, speaking for myself alone, I have no hesitation in asking for the termination of pregnancy in a young woman who has had a severe hyperthyroidism and who becomes pregnant after her thyroid surgery within a year to eighteen months. The delay, after the cure of such a condition, of eighteen months to two years before attempting pregnancy does not diminish their procreative potentialities, but it insures a healthy mother and a much healthier offspring.

DR. MORTIMER D. SPEISER.—I would like to ask Dr. Heyd whether he has had any experience with thiouracil in the group of patients with recurrent hyperthyroidism. It is my impression that with this drug some of these patients with recurrent hyperthyroidism might be carried to term.

DR. HEYD.—Dr. Speiser brought up an interesting question. Resection of the thyroid is the only means of permanently terminating hyperthyroidism. Thiouracil is capable of reducing a plus basal metabolism only as long as the patient takes the drug. It is, however, a dangerous drug, with 11 per cent toxic reaction and occasionally the cause of death by producing agranulocytosis. A pregnant woman with hyperthyroidism will not abort following resection of the thyroid. Accordingly, if the patient with hyperthyroidism is pregnant, we perform the thyroid surgery and let her continue her pregnancy. On the other hand, we urge the patient after a thyroid operation for hyperthyroidism not to become pregnone for a year to eighteen months on account of the liability of recurrent hyperthyroidism.

DR. CHARLES A. POINDEXTER (by invitation).—Patients with organic cardiovascular disease represent the largest groups in Dr. Dannreuther's series. Our Cardiac Clinic at the New York Post-Graduate Hospital is large. Quite naturally our census of rheumatic valvular disease is also large. To me these few cases seem to be quite small in number and represent an ultra-conservative attitude. We do not recommend abortion for cardiac patients unless we feel it is very necessary.

In diseases other than cardiovascular, socio-economic factors are not so important, but, before making a judgment, a cardiologist must look further than just the physical findings. He should know the conditions under which a patient must exist during the period of pregnancy. A social service report, particularly of home conditions and the potentiality for adequate care is necessary. The difference between excellent care at home as compared to climbing five or six flights of stairs several times a day and the burden of cooking and caring for several other children is tremendous. Socio-economic factors *are* important in heart disease and too often in statistical studies these factors are forgotten.

I would like to make a plea for a thorough cardiac study of each patient in order to evaluate the patient's cardiac status. It is a relatively simple matter to carry out such a study. This does not mean just an electrocardiogram and fluoroscopic examination. It means an extremely competent history in which an effort is made to actually evaluate what the patient is able to do physically, and attempt to evaluate the reaction of the heart to increased work such as pregnancy brings on. Of course, the examination usually includes electrocardiographic and fluoroscopic studies. It also includes, needless to say, a thorough general physical examination. But, of the necessary studies, probably the most important of all is to find out as best you can from the history exactly what the patient is able to do because, after all, that is the final test, and one cannot rely too much on the so-called functional tests which, in our experience, have been of little practical value.

Of the cardiac patients we have seen, most listed in Dr. Dannreuther's figures come under the classification of rheumatic heart disease with mitral stenosis. Mitral stenosis is a rather common heart lesion, particularly on the lower East Side, and it is a lesion which very often, most unfortunately, is not recognized. Therefore, I would like to remind you of a few simple diagnostic criteria, i.e., a presystolic or diastolic murmur, best heard at the apex of the heart. (This murmur is easily missed if you do not listen at the exact apex.) Another finding, frequently forgotten, is that patients with mitral stenosis do not have very much cardiac enlargement. It is only when trouble develops due to chronic failure mitral stenosis that heart enlargement occurs. In the average case no enlargement is discovered unless a careful fluoroscopic examination is made, and then the enlargement may be limited to the left auricle, and yet these are the patients who may get into trouble by having sudden failure.

There are one or two other factors that I would like to emphasize in connection with mitral stenosis, based upon our experience. When there is evidence of potential right heart failure, anything which will decrease the depth of respiration is likely to precipitate cardiac failure even in a patient who has been well compensated, and the patient may die very quickly. This is not seen as frequently in obstetrics as preoperatively. However, I believe it happens quite often in the second stage of labor during the time that the uterus is emptied during delivery. With the sudden decrease in intra-abdominal pressure, the return flow of blood to the right heart is diminished, and the vital capacity is decreased at the same time.

We do not know much about what pregnancy does to the future health and longevity of the cardiac patient. This problem is very difficult to evaluate and, with more experience, I am becoming more and more conservative about trying to say what pregnancy is going to do to the woman with heart disease. If one thinks he is going to get cardiac failure, the initial pregnancy is going to be a very important factor in shortening the patient's life. However, cardiac failure does not happen very often in pregnancy. In rheumatic heart disease, when failure does occur, I believe that pregnancy shortens the patient's life.

Statistical analyses dealing with morbidity and longevity are so technically difficult and fraught with so many variant errors, even with a seemingly adequate control group, that I believe we should be careful about personal observations made on a small series of cases.

In regard to the question of the 14 deaths in the group of 840 patients with rheumatic heart disease, as referred to by Dr. Norton, I would say that I do not know. Our cardiac cases are a somewhat selected group, culled for the purpose of teaching. We have, therefore, more of the advanced cases with severe valvular lesions. However, I do not think that 14 deaths are an exceedingly high number for a group of 840 cardiacs over a period of six years. Fourteen might die of the intercurrent failure anyway, but I think from our group of 1,200 patients, five therapeutic abortions would be far too small.

I don't see how anyone can divorce the socio-economic factors in the cardiac from this question of indications for abortion. I feel that it cannot honestly be done; it is too important a factor to ignore.

DR. EDWARD A. SCHUMANN (by invitation).—I was impressed in observing Dr. Dannreuther's statistics, when contrasting them with the statistics from the Margaret Hague Maternity Hospital, with the fact that these patients were admitted, not to an obstetrical institution, but to a general hospital. Therefore, they were viewed more from the standpoint of the coincident disease, such as hyperthyroidism and cardiac disease, as discussed by Dr. Poindexter, than the pregnancy itself. I make no doubt at all, with due respect to the essayist, that a number of these patients could have been carried through their pregnancy without undue disturbance rather than having abortions produced upon them, had they been originally admitted to a hospital such as Dr. Cosgrove's, where every emphasis is placed on the retention of pregnancy rather than the mere coincident disease. Consequently I feel that a number of them would not have been aborted and probably would have lived through it.

However, I am more and more impressed with the fact, and if you will pardon me, religious considerations aside, that we have been a little too much concerned with, let me say, the sanctity of pregnancy. Personally, in a member of my own family, if there was any consideration of disability or death from cardiac disease or hyperthyroidism or other indications, I would largely disregard an incipient pregnancy and have a small inconsequential fetus removed without concern to myself or to my patient. I think we are apt to be too hyperconservative and think too greatly about the fetus. At any rate, in this series of interrupted pregnancies, 84 in 25,000 hospital admissions (many of them were not concerned with pregnancy at all and another group was beyond the child-bearing age). Nevertheless, I still feel that in a large number of admissions, 84 terminations of pregnancy are not to be considered at all, and I wish to express myself as being in entire accord with the Post-Graduate Hospital in the termination of pregnancy with the greatest freedom if there is any danger to the life of the patient from the retention of that pregnancy.

DR. ROBERT A. MAC KENZIE.—Dr. Dannreuther's essay has made clear that the indications for therapeutic abortion at the New York Post-Graduate Hospital have been most carefully studied, and I share with Dr. Schumann the feeling of being in accord with Dr. Dannreuther's attitude and acts. It is my observation and belief, however, that in many hospitals therapeutic abortion has been viewed in less serious aspect, and the indications have not been as carefully considered before operation. Dr. Cosgrove's recent significant contribution to this topic points to the same conclusion.

It may be of interest to report here arrangements made at the Monmouth Memorial Hospital in Long Branch, New Jersey, to provide for therapeutic abortion in the occasional

case where definite irrefutable indications are present, but to eliminate the questionable cases where consultations to approve interference ofttimes have been such in name only. The Medical Board of the hospital has created a "Committee on Abortion." There are three members; the Chief of Staff who presides as Chairman, and one member each from the medical and obstetric departments. Each member is appointed for one year. The Committee meets upon call of the Chairman when there is need to consider the facts in a case to be presented by a physician who feels that abortion is necessary. If not already a patient in the hospital, the candidate for the abortion is expected to be in the hospital waiting room for questioning and examination. The decision of the Committee may be reserved until a laboratory test or other information has been obtained, but must be given within twenty-four hours of this time. Unanimous approval of the three members is required. Such approval, if voted, is to be recorded on a hospital chart before the pregnancy is interrupted. In the event that one of the members of the Committee wishes to present a case, his place is taken by another doctor selected from his department by the Chairman.

The formation of such a board of review has several advantages. It provides a meeting of minds with opportunity for discussion and decision upon the merits of each case. No physician is going to ask the Committee to consider a case which he has not carefully studied, nor about which he does not feel strongly. No woman will consent to be taken to the hospital for possible examination and interrogation unless she desperately feels the need for help.

In the twelve months preceding the establishment of this Committee, eight therapeutic abortions were performed. There have been no induced abortions in the nine months since the Committee has functioned. Two cases of early pregnancy with complicating conditions have been presented for study. In each case it was decided not to recommend interference.

DR. GEORGE H. RYDER.—Are we to limit therapeutic abortions to medical indications only? Shall we disregard entirely economic conditions? Are we to sanction therapeutic abortions solely for saving the lives of women at the time or shall we take into consideration their future health also?

What about hard-working women in poor health, with little money, who already have five or six children? Often we know that they do not have the strength to go through another pregnancy and to take care of the new babies in addition to the children at home. Shall we force them to go through additional pregnancies simply because we think that they will not die in childbirth?

In the Margaret Hague Hospital in Jersey City, with but four therapeutic abortions among seventy thousand pregnant women, it seems that the plea of such women must have been disregarded.

DR. HARRY ARANOW.—I have come to the conclusion that, on this question, after all, we are swayed by sentiment and that with all this discussion no one is convinced in the end. As Dr. Schumann brought out, sentiment plays a role. For example, if a patient was threatened with illness or death if pregnancy progressed, I would permit her to have an abortion, whether the fetus was important or not, and whether the pregnancy had advanced to the second, third, fourth, or sixth month. I may be wrong in that, but after an obstetric practice of about thirty-five years I do not feel I myself am competent enough to decide whether the heart will stand labor, or whether a patient with tuberculosis or thyroid disease is going to get worse. I take it for granted that the man who advises me is honest and sincere and, while I can reserve decision, I am swayed by the opinion of the consultant most of the time.

DR. E. EVERETT BUNZEL.—Discussing therapeutic abortion in a general hospital, I believe that this calls for an answer to two questions: What is therapeutic abortion? What is a general hospital? Therapeutic abortion, in my opinion, is one in which termination of pregnancy is indicated to prevent the advance of disease or where there is a threat to the life of the expectant mother. A general hospital includes an obstetric division, which the Post-Graduate Hospital does not have.

I would like to know if there are any statistics of the number of patients admitted to this hospital who were refused therapeutic abortion once they were admitted. It seems to

me that an obstetric opinion would be very essential, in addition to the opinion of a general medical man and a gynecologist. I have seen many patients with cardiac disease, particularly of the rheumatic type, who have been referred by outside agencies with a recommendation that therapeutic abortion be done. Granted that there is a history of rheumatic heart disease and that the patient shows evidence of mitral stenosis, how do you determine, as the essayist brought out so well, whether this particular patient is one who deserved emptying of the uterus? It seems to me that in most of the instances where there is an element of doubt, and certainly that exists in at least 50 per cent of patients admitted to a prenatal clinic, such patients should be admitted to the hospital for observation and study to determine the cardiac reserve.

I agree with Dr. Dannreuther that one of the most important things is the history which we get in these cases and I for one wish to go on record as saying that I am perfectly willing to recommend therapeutic abortion in a patient with rheumatic heart disease if there is a history of a period of decompensation within one year prior to the onset of pregnancy. You can be almost sure that as the pregnancy progresses, and as this living tumor increases in size and produces pressure on the diaphragm, with a decreasing amount of thoracic space available for respiratory use, that the patient will become more and more dyspneic, cyanotic, and orthopneic. She is much more apt to experience greater difficulty as pregnancy advances, unlike tuberculosis where the lesion is not much increased, if at all, during the course of pregnancy.

I believe that electrocardiographic tracings are essential, that the two-meter plate is important, as well as determination of kidney function.

In the cases that were aborted at the Post-Graduate Hospital nothing was said about the method of interruption; nor the time when the pregnancy was interrupted. Nothing was said as to how many patients were subject to hysterotomy and sterilization when the condition was so far advanced that it was thought these patients should never again become pregnant; whether the patient was able or willing to use contraceptive devices. There were four cases in which pregnancy was interrupted because of a history of epilepsy. I don't know just why epilepsy should constitute an indication for therapeutic abortion. The neurologists are very much at odds as to whether that is a hereditary disease. They admit that during pregnancy a patient with epilepsy is far better than before, but that the epileptic seizures will recur following pregnancy. Interruption of pregnancy does not cure epilepsy.

So far as the thyroid operations that Dr. Heyd referred to, I agree with him absolutely. We have had several cases in which partial or total thyroidectomy was done in the early part of pregnancy and I know of only one instance in which spontaneous abortion followed thyroidectomy. We do not know that this particular patient would or would not have aborted anyway. Certainly the weight of evidence would be in favor of assuming that the thyroidectomy was not responsible for the so-called miscarriage which occurred following the operation.

DR. DANNREUTHER (Closing).—I would like to emphasize that, when I originally compiled the statistical data, it was done only to secure the figures indicating the frequency of therapeutic abortions during a ten-year period. Although no charts were inspected or reviewed, the total number of cases, 84, seemed creditably small. Perhaps it was higher than it should have been. In this group of cases, many of the abortions were done before the adoption of the existing hospital rules, and possibly some of them would be refused today.

Personally, I have seen a larger percentage of the candidates for therapeutic abortion since these rules have been in effect than I did previously. However, I cannot tell Doctor Bunzel how many patients were refused a therapeutic abortion, and know of no way whereby such information could be secured from the record room. It would also seem an almost impossible task to prove exactly to what extent a therapeutic abortion contributes to the prolongation of life expectancy. It would be wrong to contend that a therapeutic abortion can cure epilepsy or a brain tumor or any other disease, and I had no intention of implying any such thing. But it may protect the health and lengthen the life of many patients whose existence might otherwise be much more distressing.

INTERPRETATION OF THE PATHOGENESIS OF PELVIC INFECTION AS DETERMINED BY CORNUAL RESECTION*

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IT IS generally accepted that the primary infecting organism in most cases of salpingitis has been the gonococcus, in spite of the fact that at operation cultures of the tubes are either sterile or reveal other organisms. This raises the following questions:

1. Does the gonococcus prepare the tube for infection by other organisms, or is a tube infected with the gonococcus more susceptible to secondary invasion?
2. Does the gonococcus disappear from the tube when these secondary invaders appear, or are they present but overgrown by other organisms?
3. How did these secondary invaders reach the tube?

These are the questions that trouble the student of pelvic inflammatory disease. Before they can be answered certain fundamental limitations in the present knowledge of the bacteriology and immunology of gonococcus must be reviewed.

A. Cohn and I. Grunstein,[1] in their discussion of the cultural methods of diagnosing gonorrheal infection, state: "little is known of the actual facts interfering with the accuracy of the bacteriologic methods, although various explanations have been advanced." One view stressed by the Gonococcus Research Unit emphasizes the fact that biologic changes in the infected tissues and their resulting action on the organisms may cause anatomic or immunologic reactions which decrease the number and viability of the gonococci.

Other investigators (Van Slyke, C. J. Thayer, J. Durward, and J. F. Mahoney)[2] believe that the limitations of the culture diagnosis is due chiefly to a lack of sensitivity of our present culture media. "Experimental evidence indicates that a minimal number of viable organisms must be present before a culture can be obtained. With the available culture media this medium represents a very large number of organisms. The ideal medium would be one sensitive enough to promote growth when a single viable organism is present in the pus specimen."

The fact that the gonococcus, when confined in a closed space like the tube soon dies, whereas when it is contained in the cervix where it has unrestrained secretions retains its virulence for a long time, has been accepted by most authorities.

Yet Curtis[3] states that "combined laboratory study and clinical experience formerly led me to the deduction that gonorrheal infections of the cervix are unusually persistent. This belief appears to require some modification. Consort re-infection accounts for more of these cases than were evident in my earlier experience, and Gram negative diplococci, other than the gonococcus, have gradually been found to occupy a somewhat more important role in the bacteriology of chronic endocervicitis."

*Presented to the Obstetrical Society of Philadelphia, Nov. 1, 1945.

One attack of gonorrhea in the cervix does not set up any immunity. There may, however, be an acquired local immunity against a certain strain of gonococci with which the patient and her consort are persistently infected. As a result, the patient does not develop the symptoms of an acute infection every time she comes in contact with this particular strain. Does this same local immunity hold in the tube? This is very doubtful, because it would appear that in the tube, with the disappearance of symptoms, the gonococci die; and, as there is no natural immunity against the gonococcus, when a reinfection takes place from the cervix along the endometrium to the tube, it is practically the same as if a new infection set in.

It has long been known that gonococci as well as streptococci may remain dormant in the cervix for years. Curtis[4] has shown that approximately 30 per cent of all patients with chronic purulent leucorrhea are carriers of virulent streptococci.

Any attempt to study the bacteriology of the infected tubes must of necessity take into consideration the fact that today it is unusual to operate on any patient during her period of active disease. It is customary to wait until the temperature and blood count have been normal for at least two weeks. As a result, the acute process has almost always subsided and the operation takes place on tubes in the subacute or chronic state.

A further complication to enter the field of the bacteriology of the infected tube is the inhibiting effect on the growth of the gonococcus and other organisms by the normal antibodies produced in the tissues, the sulfonamides and penicillin.

The fate of the gonococcus in the tube has long been under discussion. If the gonococcus invades the wall of the tube, does it reproduce in the wall of the tube as a gonococcus, or does it change its morphology and no longer appear as a diplococcus, as suggested by Casper.[5] With the advent of other organisms in the tube does the gonococcus disappear or do these other organisms, streptococci, staphylococci, etc., so completely overgrow the gonococcus that the latter cannot be isolated from the infected tube?

The bacteriology of the infected tube has been studied in many gynecologic clinics and there has been an almost unanimity of opinion that organisms (gonococci, streptococci, staphylococci, etc.) cannot be cultured from the infected tubes in any large percentage of cases if one waits two weeks after the temperature has subsided.

Curtis[6] found that, in cultures made from over 200 thoroughly ground Fallopian tubes, it was rarely possible to obtain the gonococcus longer than two weeks after the disappearance of fever and leucocytosis. Studdiford, Casper, and Scadron,[7] found organisms identified as gonococci in the tubes of 66.6 per cent of 24 cases of salpingitis investigated bacteriologically, in spite of the fact that none of them were in the acute stage of the disease. Most of the patients had been afebrile for two weeks. Cohn and Grunstein[1] examined the operative material of 19 patients from Bellevue Hospital. Bacteriologic material for smears and cultures were taken from 14 inflamed Fallopian tubes, seven ovaries, two uterine cavities, and from a ruptured tuboovarian abscess. After surgical removal, the different organs were opened, and any exudate present on the sur-

face of the mucous membrane was taken up by a sterile swab which was immersed in peptone water. The mucous membrane was then scraped with a sterile knife in order to obtain exudate from the deeper layers of the inflamed tissue. In some cases pieces of tissue were excised, immersed in peptone water, and ground up in a mortar before final inoculation into culture media. All of this operative material yielded negative bacteriologic findings.

A study of the bacteriology of infected tubes was undertaken at Harlem and Beth Israel Hospital. At first only the cornual portions of the tubes removed at operation were used for culture. These cultures were almost always sterile and histologic examination of the tissue removed at operation frequently showed no pathologic change. As a result, for this study tubes were removed in toto and subjected to smears and tissue cultures.

*The Technique Used for Culturing Tubes** (Beth Israel Hospital).—The surgeon removed the specimen (the uterus with tubes and ovaries), and placed them in a sterile specimen jar. The technician, with sterilized instruments, separated the tubes from the ovaries and uterus and placed each tube in a sterile Petri dish and opened the tube longitudinally with sterile scissors. The lining of the tube was then scraped with a strong loop or wooden applicator. Cultures were then made on chocolate agar plates and a smear taken for study. A portion of the proximal and distal part of the tube was excised and placed in separate Petri dishes to be used for tissue culture. The specimens were then carried to the laboratory and cultured on different media.

In the laboratory the slide was stained (gram's technique) and examined microscopically. Each of the remaining parts of the tube were scraped thoroughly with a loop and cultured on chocolate agar, endo-agar, blood agar and Fortner plates (for anaerobes). The tissue particles were taken from the Petri dishes and placed in a fluid media such as thioglycollate, plain broth, and proteose peptone. All media were placed in a 37° C. incubator and the chocolate agar plates were put in a 20 per cent CO_2 atmosphere. After twenty-four hours all media were checked. Those with growth were smeared and subcultured. Proteose peptone cultures were transplanted to chocolate plates, even if no viable growth was present. All media were observed as follows: endo-plates for forty-eight hours, chocolate agar and anaerobic plates for three days. The tissue in proteose broth was kept eight days and subcultured again for final examination. All positive cultures were subcultured for isolation and final determination.

In the first series 140 cases were studied, 108 cases gave negative cultures, 5 cases were contaminated, and 27 cases gave positive cultures. These were as follows: *Salmonella typhi murium,* 2, *Streptococcus hemolyticus,* 5, *Bacterium coli,* 6, *Streptococcus viridans,* 11, *Bacterium lactis aerogenes,* 1, *Micrococcus gonorrhoeae,* 2.

A second and independent bacteriologic study was then undertaken in the bacteriologic department of Harlem Hospital.

Technique Employed in the Bacteriologic Study of the Fallopian Tube.†—As soon as the portion of the tube was brought to the laboratory it was placed in a sterile Petri dish. The mucous membrane was exposed and scraped with a

*This work was aided by a grant from the Greater New York Fund.
†This work was aided by a grant from the Gynecologic fund of Beth Israel Hospital.

strong wire loop and the material cultured. Pieces of the tissue were also cultured. All material was placed on the following media:

1. Blood agar
2. Thioglycollate broth (Brewer)
3. Brewer's anaerobic agar
4. Proteose No. 3 agar with hemoglobin and plasma enrichment—plasmahem agar.

A smear was also prepared from the scrapings of the tissue. This was stained by means of Gram's technique. The presence or absence of microorganisms and pus cells was recorded.

The blood agar plate, thioglycollate broth, and Brewer's anaerobic plate were placed in the incubator at 37° C. The plasmahem plate was placed into a 10 per cent CO_2 atmosphere, incubated at 37° C. for thirty-six to forty-eight hours, and then examined for gonococci. Suspicious colonies were subcultured for purity and then examined for gonococcal, physiologic, and morphologic, properties.

A Gram negative diplococcus was recognized as a gonococcus by its:

1. Typical colony formation
2. Failure to grow at room temperature
3. Ability to ferment dextrose and not maltose.

The blood agar plate and Brewer's anaerobic plate were examined daily for four days and the thioglycollate broth for ten days. Obviously as growth was visible, the usual bacteriologic procedures were used for the isolation and identification of microorganisms found.

In this second series 76 cases were studied

Sixty-four cases gave negative cultures.
Twelve cases gave positive cultures.

The positive cultures were as follows:

Staphylococcus aureus hemolyticus	6
Staphylococcus albus	1
(Microaerophilic) gram negative bacillus	1
Nonhemolytic Streptococcus	1
Gram negative diplococcus not gonococcus	1
Gonococcus	2

In no instance were microorganisms demonstrable on smears, although the smear on four occasions showed 2 and 3 plus pus. These two studies verify the findings of Curtis,[6] that, when the acute symptoms subside, organisms which can be cultured have disappeared from the tube. If this is true, then how does the second, third, or fourth attack of salpingitis occur? Is it a lighting up of a latent or dormant infection in the wall of the tube which cannot be demonstrated by our present bacteriologic methods, or is it a new infection from without the tube (i.e., male carriers, cervix, etc.)?

For the past eight years it has been the custom at Harlem Hospital not to remove pus tubes. The tubes were only removed when the ovary was involved (tuboovarian abscess or ovarian abscess). Instead, the continuity of the tube, uterus, and cervix was broken by resecting the cornual end of the tube and leaving the rest of the tube in situ. The reason for this procedure was that, as demonstrable organisms had disappeared from the tube after the temperature

had been normal for two weeks the tube could not reinfect itself, but was infected from without through the cervix and uterus. Whether this occurred from an infected consort or an infected cervix did not matter.

If this concept is true, then leaving in the infected tube and breaking its continuity with the cervix should prevent reinfection of the tube. If, however, this concept is not true and reinfection of the tube occurred as a "lighting up" of a latent or dormant infection in the wall of the tube, then breaking the continuity of the tube with the cervix should not prevent attacks of recurrent salpingitis.

Cornual resection[10-13] has been carried out in over 1,000 cases with a follow-up of over eight years, and in no instance have we seen or heard of a reinfection occurring in any of these resected tubes. Since all the patients in Harlem Hospital are indigent patients, they, of necessity, when sick, must reapply to Harlem Hospital or to some other City Hospital for admission. None of these cases have been readmitted to Harlem Hospital with a recurrence of the salpingitis. We have not heard of any of these cases being admitted to any other hospital for treatment for pelvic inflammatory disease after cornual resection. We have, however, had an opportunity to reoperate on six of these patients who subsequently developed fibroids or ovarian cysts as a complication. In all of these cases the tubes were removed at the second operation for study. In no instance were we able to demonstrate in these tubes, removed nine or more months after the cornual resection, any histologic evidence of acute or chronic inflammatory disease.

This brings us back to our original questions:

1. Does the gonococcus prepare the tube for infection by other organisms, or is a tube infected with the gonococcus more susceptible to secondary invasion?
2. Does the gonococcus disappear from the tube when these secondary invaders appear, or are they present but overgrown by other organisms?
3. How did these secondary invaders reach the tube?

There is no doubt from the material studied in the Harlem Hospital Out-Patient-Department that the primary infecting organism in most cases was the gonococcus. Patients entering the hospital in their primary attacks of salpingitis demonstrate by smear and culture the gonococcus from the cervix in a fairly high percentage of cases. Primary streptococcus or staphylococcus infection of the tube may occur, but is infrequent.

It is evident from this study and those of a majority of other observers that in patients who have had frequent attacks of salpingitis, the gonococcus had disappeared from the tube, and other organisms have replaced them. There is no question from bacteriologic and pathologic studies that these secondary invading organisms play a prominent role in pelvic inflammatory disease.

It would therefore appear that the gonococcus is either overgrown or replaced by these other organisms. As primary streptococcus and staphylococcus, etc., infection of the tube is infrequent, and as these organisms play such a prominent role in pelvic inflammatory disease, is it not probable that the tube infected with the gonococcus is more susceptible to these secondary invaders?

It has long been generally accepted that the gonococcus ascends from the cervix through the cavity of the uterus to attack the tubes from within (luminal infection), whereas the streptococcus and staphylococcus are presumed to go by way of the lymphatics and attack the tubes from without (mural infection).

Is the gonococcus the only organism that attacks the tubes from within? Is it not probable that when circumstances are appropriate—low resistance, endometrial reaction, instrumentation, etc.—the streptococci and staphylococci, which are present in the crevices of a great many women, enter the uterus and thus gain access to the tubes? This probably is true in spite of the fact that it has long been taught that the streptococcus and staphylococcus are lymphatic organisms and extend through the broad ligaments to the wall of the tube and produced a perisalpingitis. Primary luminal streptococcus, staphylococcus, and coli bacillus infections of the tube usually produce a generalized peritonitis (Falk and Blinick),[12] although one must admit the possibility of a low-grade primary infection without peritonitis. Black-Schaffer[13] studied the tubes removed from 50 patients at varying intervals during clinically normal puerperia. In 19 cases he found acute salpingitis. The mucosa of the tubes was the stratum most prominently involved. In those tubes which showed the most advanced lesions, aggregates of polynuclear leucocytes were seen in the edematous hyperplastic muscularis and subserosa. In no case was the peritoneum involved. Since the inflammation probably spread along the endometrium to the mucosa of the tubes, he assumes that an unrecognized postpartum endometritis must have existed.

In patients who have had recent attacks of recurrent salpingitis, we have been able to demonstrate in sections of the fundus of the uterus evidence of recent inflammation, leucocytic infiltration, etc. Bell[14] stated that many of his cases of chronic salpingo-oophoritis were associated with chronic infection of the fundus of the uterus. Beck, quoted by Polak,[15] stated that a microscopic study showed that infection from the tubes spreads into the mucularis of the uterus to a considerable extent.

It is our belief that this infection, whether gonorrheal, streptococcal, or staphylococcal, did not come from the tube to the fundus of the uterus, but that the infection began at the cervix, extended upward to the fundus of the uterus and then outward to the lumen of the tubes. If this is not true, how else can we explain the absolute disappearance of the infection in the tube on performing a cornual resection. If the tubes reinfect themselves, why did we not have a single case of recurrent salpingitis with fever in a patient on whom the only procedure was a resection of the infected tube from the cornua of the uterus, thus breaking its continuity with the cervix.

Conclusions

1. The fact that the gonococcus is the infecting organism in most cases of primary salpingitis is accepted.

2. The question as to whether the gonococcus prepares the tube for subsequent infection by other organisms is discussed.

3. The fact that the streptococcus, staphylococcus, and other organisms may ascend through the uterus to the tubes is discussed.

4. The recovery of organisms—gonococci, streptococci, and staphylococci—from infected tubes is infrequent.

5. Cornual resection prevents reinfection of the tubes.

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1 West Eighty-Sixth Street

Discussion

DR. EDWARD A. SCHUMANN.—This essay opens a wide field for discussion, aside from the specific questions Dr. Falk has asked and answered.

Gynecologists are agreed that the gonococcus is the most common infectious agent in the causation of pyosalpingitis, and the modern conception of its subsequent fate in the tube has been well stated by the essayist. Gonorrhea is now generally considered to be a self-limited disease in both sexes, chronicity being somewhat doubtful except possibly (and only possibly) in the cervix. Residual lesions are, of course, common stricture and prostatic involvement in the male, agglutination of the tubal mucosa, and peritubal adhesion in the female. However, the lighting up of a so-called latent gonorrheal infection seems to be an erroneous conception, it being much more probable that reinfection has occurred. The original work of Curtis has never been disproved and showed conclusively that the life of the gonococcus in the tube was comparatively short.

Secondary infection by pyogenic bacteria frequently follows specific infection in various organs, the kidney, gall bladder, and tonsil being commonly so affected.

To me the most interesting part of Dr. Falk's paper was his statement, supported by a large number of case histories, that secondary and subsequent infections of the Fallopian tubes did not follow an initial healed salpingitis when the uterine cornua were resected and the tubal mucosa thus cut off from the uterine cavity.

This would seem to prove, by simple clinical observation, that tubal infections travel along the endometrium and reach the tubes by the cornual passages and not by way of vascular or lymph channels.

The quoted work of Black-Schaffer is of great importance in this connection as has been stated. This author studied the tubes removed from 50 patients at various intervals during clinically normal puerperia. I assume that these specimens were mostly obtained after postpartum sterilization procedures, and in almost 40 per cent of these cases he found acute salpingitis, although in none of them was the peritoneum involved. This certainly seems to point to direct infection by continuity rather than a lymph- or blood-borne invasion.

With regard to repeated attacks of salpingitis, it seems reasonable that there are either frank new infections by the gonococcus or that certain pyogenic bacteria, gaining access to the tubes via the uterine cavity, are able to develop readily among the debris of the original infection, since all tubes once the seat of a salpingitis reveal, upon close examina-

tion, little crypts where the mucosal papillae have become agglutinated as well as certain areas of ischemia form tiny infarcts, together with areas of inhibited lymph flow, all of which form excellent fields for bacterial growth.

DR. ROY W. MOHLER.—I have had occasion a number of times to do cornual resections with about the same technique that Dr. Falk has described. I have observed very carefully for a number of years four or five patients on whom I have done cornual resections. Each patient has been clinically well during the whole period of observation. The patients were girls who had recurrent pelvic infections. I was very anxious in these particular patients not to remove the ovaries. Against my better judgment in the first few cases, I did cornual resection, and my subsequent observations have indicated that the patients are clinically well.

DR. FALK (Closing).—I was asked about the advantage of leaving the tube in situ. I would prefer to state the disadvantages of removing the tube. Every year we see at least a dozen patients with ovarian cysts whose tubes have been removed and in whom the ovarian blood supply has been interfered with. Intestinal injury is not an unusual complication of salpingectomy. Cornual resection is a simpler operation with fewer complications.

Dr. Schumann's question with regard to the demonstration of the gonococcus in the endometrium; to demonstrate the gonococcus in the endometrium it is necessary to remove the uterus during the primary acute attack which is not done today. Wertheim, however, did demonstrate the gonococcus on the endometrium about 40 years ago. In answer to Dr. Outerbridge's question, we have left in pus tubes with a diameter of four centimeters. The first case operated upon had pus tubes three centimeters in diameter. A cornual resection was performed and she left the hospital in two weeks, going back to work. We were able to follow her very carefully. The mass entirely disappeared. We are hoping to have one of these patients return as a sterility study. We are anxious to see if we can reimplant the uterine end of the tube into the cavity of the uterus and have a pregnancy result. We doubt it very much as the fimbriated end of the tube will probably be closed in most of the cases.

THE CLINICAL DIAGNOSIS OF VARYING DEGREES OF UTERINE CONTRACTION RINGS*

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IT IS a great honor to be invited to present the first paper under the "C. R. Hannah Memorial Lectureship." I fear that it will fall far short of being worthy of the founder of this society, the oustanding teacher, and the intimate friend of most of us present. Dr. Hannah was dynamic. He liked one to argue his point, right or wrong, with firm conviction. He also wanted one to be brief. I trust his soul will not be disquieted by this presentation.

I have chosen the subject, "The Clinical Diagnosis of Varying Degrees of Uterine Contraction Rings," because Dr. Hannah was interested in contraction rings, and because delving in the subject has been very interesting to me. Moreover, I am convinced that the delay in some otherwise normal labors is often caused by subclinical uterine rings. In two former papers[1, 2] read before our State Society, various phases of the subject, especially etiology and treatment, have been discussed. While these papers did not offer any great contribution to the literature, they have stimulated interest in ring dystocia among some of our doctor friends, as will be seen from Table I.

TABLE I. INCIDENCE OF CONTRACTION RING DYSTOCIA AS DETERMINED IN DIFFERENT INSTITUTIONS

Drs. Johnson and Johnston:	
10,000 Consecutive Cases	
Contraction Rings	126
Incidence 1.26% (1 in 80 Deliveries)	
St. Joseph's Maternity:	
24,524 Consecutive Cases	
Contraction Rings	97
Incidence 0.39% (1 in 254 Deliveries)	
Memorial Hospital:	
10,461 Consecutive Cases	
Contraction Rings	28
Incidence 0.26% (1 in 402 Deliveries)	

In this table it is noted that in our practice ring dystocia occurred once in every 80 deliveries; whereas at St. Joseph's Maternity where most of our cases are delivered it occurred only once in every 254 deliveries; and at the Memorial Hospital it occurred once in every 402 deliveries. Obviously, these apparent differences in incidence of this complication of labor are not real but represent varying degrees of interest in or awareness of it.

A few introductory remarks about uterine rings might be in order. The occurrence of a physiologic retraction or contraction ring at the junction of the

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upper and lower uterine segments is well established. Whether it forms during the last trimester, just before, or during labor, is still a disputed question. Williams,[3] specimen of a seven months' pregnancy shows the ring or ledge well defined. Beck's[4] drawings perfect the lower uterine segment and the physiologic ring as the first stage of labor progresses.

Proceeding to the realm of pathologic rings, one is confronted by a maze of bewildering terminology and assumptions. Less confusion would result if the authors of our acceptable textbooks could agree on a standard nomenclature, deleting or leaving in small type all duplications of terms. There are, according to them, retraction rings, contraction rings, and constriction rings. The student is told that the two former may be temporary or permanent, passable or impassable, reversible or irreversible. One author refers to Bandl's ring as a progressing process of retraction at the site of the physiologic ring; claims that the ring moves gradually upward as the upper segment thickens; that the lower segment becomes markedly thinned, and it is in this segment that rupture of the uterus takes place; and that this process occurs only in obstructed labors. DeLee and Greenhill,[5] citing Rudolph as their authority, call the ring a constriction ring because it is essentially a functional constriction which may occur at the external or internal os, at any level of the lower uterine segment, at the site of the physiologic ring, or at any level of the upper uterine segment. They use the same authority for claiming that constriction rings may be atavistic, representing segmentation of the uterus—as found in Rodentia, Carnivora, and Ungulata; that the cause of the ring formation is unknown, and that there is no evidence that early rupture of the membranes, bags, drugs, malposition, malpresentation, or intrauterine manipulation are causative factors.

The foregoing is confusing to medical students and doctors as well. With or without good obstetric authority, *Standard Nomenclature of Diseases and Operations* has taken the first step toward clarification. In those hospitals which have adopted the Standard Nomenclature, rings are now all contraction rings. The terminology used in this paper has been made statistically and otherwise to conform to Standard Nomenclature. In former papers the term Bandl's retraction ring has been preferred, since (a) the term has quite general significance, and (b) in answering the question "is the constriction now present in the uterus due to constriction, contraction, or retraction of the muscle fibers?" it has been more natural to think of the constriction or ring as being due to a process of retraction. But in spite of our present-day confusion, we have good authority, in addition to our own personal experience, to be convinced that rings occur in both obstructed and unobstructed labors and, when present, are always a formidable complication to the progress of labor.

In the first group of cases, obstruction to the passage of the fetus causes development of the contraction ring, while in the second group the contraction ring causes obstruction to the passage of the fetus. In the first group the ring formation would be dependent on the degree of obstruction to labor. In the second group, and it is this group with which this paper is mostly concerned, all cases might be divided by their clinical courses into mild and severe. The mild

cases would comprise all labors where other causes of dystocia could be eliminated and which greatly exceeded the normal duration, but which terminated spontaneously or by simple delivery procedures under the lower limit of prolonged labor, i.e., thirty hours. The severe cases would comprise labors which greatly exceeded thirty hours and terminated under surgical anesthesia by more involved delivery procedures. There are varying degrees of toxemia, placenta previa, premature separation of the placenta, et cetera. If contraction ring dystocia in unobstructed labor is an entity, it appears reasonable to suppose that it also might occur in varying degrees even down to a definitely sub-textbook variety.

In reviewing the literature up to 1935, Rudolph reported that in his 371 collected cases the maternal mortality was 15 per cent; the fetal mortality, 46 per cent; operative incidence, 97 per cent. In 1941 the writer reported 105 cases of Bandl's ring occurring during 7,339 labors in the practice of Johnson and Johnston. Operative interference was 100 per cent, maternal mortality nil, fetal mortality 4.7 per cent. It seems obvious that, in view of these great discrepancies, Rudolph collected from the literature the most severe and perhaps neglected cases. It is hoped that our cases were not neglected, and that delivery was effected as early as circumstances warranted. His were the grave cases; ours the milder ones, but nevertheless offering a definite delay in the progress of labor, and susceptibility to the diagnosis of ring dystocia. It is these varying degrees of ring dystocia, or milder cases, which, if observed carefully, cause one to become more ring conscious, with the result that the true cause of the unreasonable delay in labor is detected. I feel that anything tending to popularize this concept will be of benefit by way of earlier interference, and thereby reduce maternal and fetal mortalities.

My experience with ring dystocia is that the textbook Bandl's ring must occur in obstructed labors, because it merely represents the ultimate result of the mechanics of expulsion in a uterus which has gone all-out to empty itself against obstruction. But unobstructed labors are greatly in the majority, and in a small percentage of these ring dystocia develops. It is also apparent that the complication may develop at any time from the beginning of labor to very late in the first stage, or even during the second stage. No doubt some few of us, in order to get a little football insurance for the game at 2:30 P.M., have ruptured the membranes at 8:00 A.M. Saturday in a normal case with 5 cm. cervical dilatation. Then, to our bitter disappointment, we not only had to miss the game, but also divine worship at 11:00 A.M. Sunday morning.

We cannot agree with Rudolph that early rupture of the membranes is not a predisposing factor in the development of uterine rings. It has happened too often in our cases to be ignored. In fact, where the membranes have ruptured before or early in labor, and subsequent cervical dilatation has not kept pace with the frequency and severity of the uterine contractions, we have become suspicious of a developing ring, and often this suspicion has been warranted. But there is much to support Rudolph's contention that temporary contraction rings are functional, for some of our severe cases have had subsequent labors without recurrence. Also, while deep surgical anesthesia is required to relax

most rings, lesser degrees of anesthesia, good sedation, or adrenalin chloride may relex the milder forms. At least, relief is sometimes afforded by these milder measures.

Apology is offered for being unable to present anything really new in the clinical diagnosis of ring dystocia. However, it may be worth while to refresh our minds on the cardinal symptoms and signs, and then to visualize these signs in the accompanying diagrams. For this purpose ring dystocia developing early in the first stage of labor is best suited. Many of these patients give a history of the mother having had a long labor. (The mother always claims there were no good doctors in those days.) Also, not a few of these patients are introspective and have looked to the very last detail of good prenatal care. As a class, if there be such, they might be called hypertonic introverts. Labor starts quite normally (Fig. 1) and then after a few hours, the complaints of the patient become urgent because of the colicky nature of the pains. Rectal examination (Fig. 2)

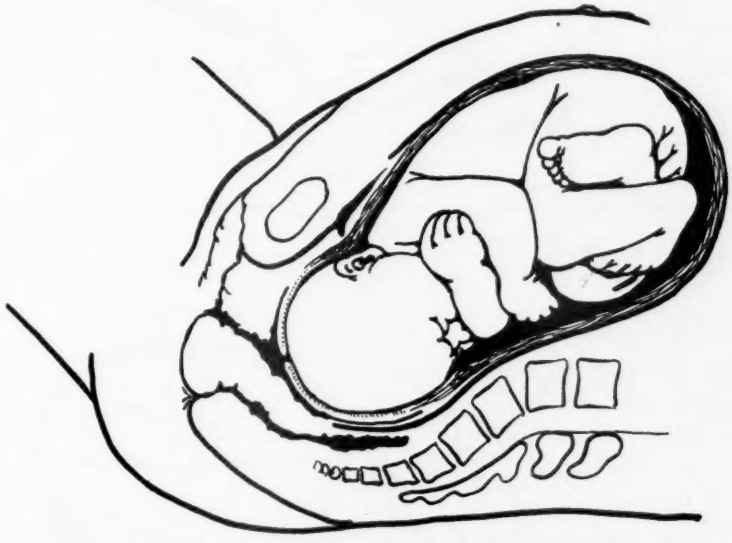

Fig. 1.—Onset of labor in primipara at term. Head engaged, cervix ripe, membranes intact. Physiologic contraction ring present.

satisfies the inexperienced that the complaints are not in accord with the progress of labor and the patient is in for a good sound scolding. Even the pallor and the small beads of perspiration mean little or nothing to him. The experienced physician, after such rectal examination, on the other hand, is conscious of what is taking place and is moved to sympathy. Immediate relief is ordered along with words of understanding and encouragement. May I state here that the popular saying and belief, "the cervix will *always* dilate when the labor pains are adequate," should be changed to "the cervix will *always* dilate when the labor pains are adequate *but only very slowly in unobstructed labors where a contraction ring is forming or has formed.*"

After a few hours of rest produced by sedation, the battle is on again, and as the hours pass the colicky character of the pains increases, the patient holds her hands over the uterus because it has become sensitive and she wants to pro-

tect it from the hands of nurses and doctors. She may now show some signs of fatigue, and the urgency of another period of rest becomes apparent. A vaginal examination may now show the station of the head to be slightly higher than noted earlier in labor. Some increase in cervical dilatation (Fig. 3) has taken place, possibly 2 or 3 cm., with soft, somewhat edematous cervical edges. The middle finger of the examining hand (Fig. 4) is inserted rather

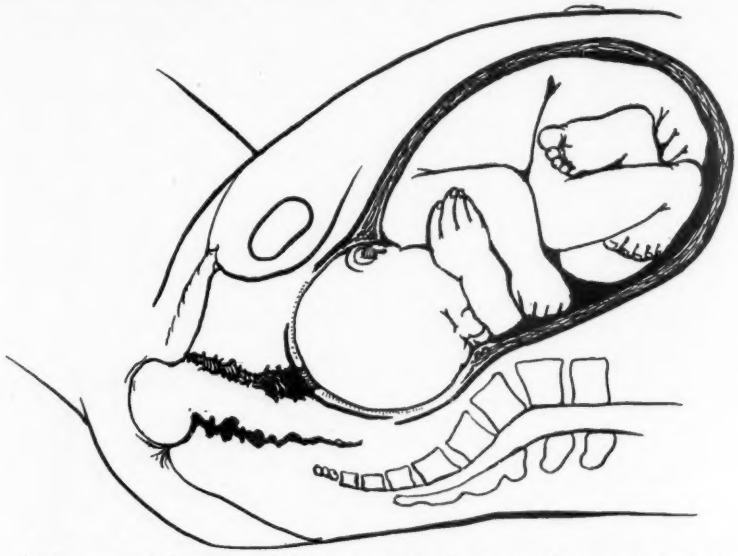

Fig. 2.—After several hours of labor, cervical dilatation does not correspond with the duration of labor nor the severity of the pains. The physiologic contraction ring is more marked.

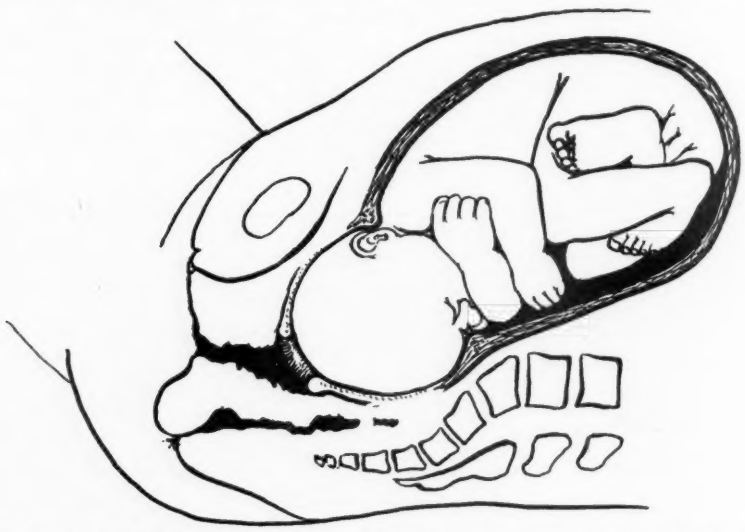

Fig. 3.—Cervical dilatation increased to 3 to 4 cm., with soft and edematous edges. The station of the head is slightly higher. The physiologic ring has become a pathologic contraction ring.

deeply between the cervix and the head. The other hand is placed on the body of the uterus and kept there until a strong contraction is felt, when the impact on the examining finger is sensed as very weak. (Fig. 5 suggests a simple method of sensing pressure of uterine contraction.) The fetal head is found to be mov-

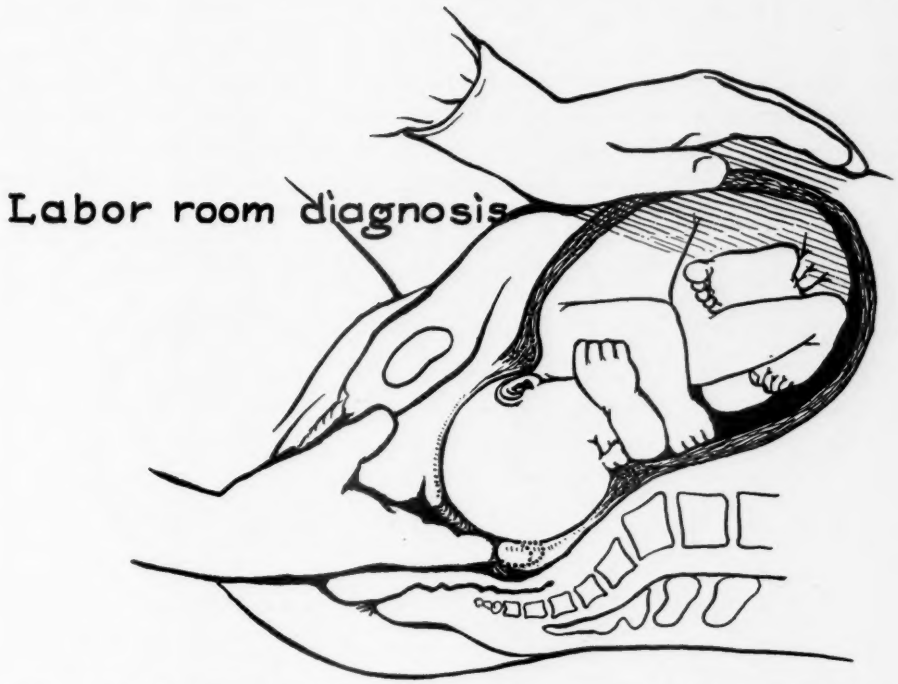

Fig. 4.—After several hours more of labor the cervix is dilated 4 to 5 cm., and is more edematous. Vaginal examination shows that pressure of uterine contraction is not imparted to the examining finger held between the cervix and fetal head.

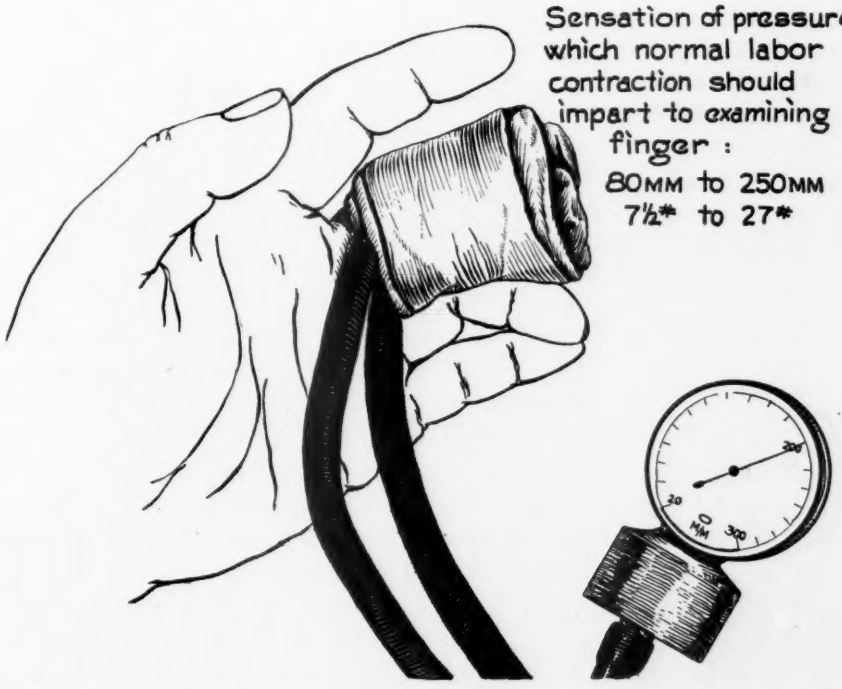

Fig. 5.—This shows the use of the sphygnomanometer to sense the amount of pressure of uterine contractions. This ranges from 7½ pounds (80 mm.) to 27 pounds (250 mm.).

able or loose in the pelvis. There can now be little question about the diagnosis. With the periods of rest and labor, thirty or more hours have now elapsed. The patient begs for a cesarean section. She knows that any medicine given her will afford only temporary relief, and she senses the utter futility of being able to deliver herself. Vaginal or rectal examination now may show the cervix 4 cm. dilated (Fig. 6), soft and edematous. The patient is now ready for delivery, and more than likely so per vaginam.

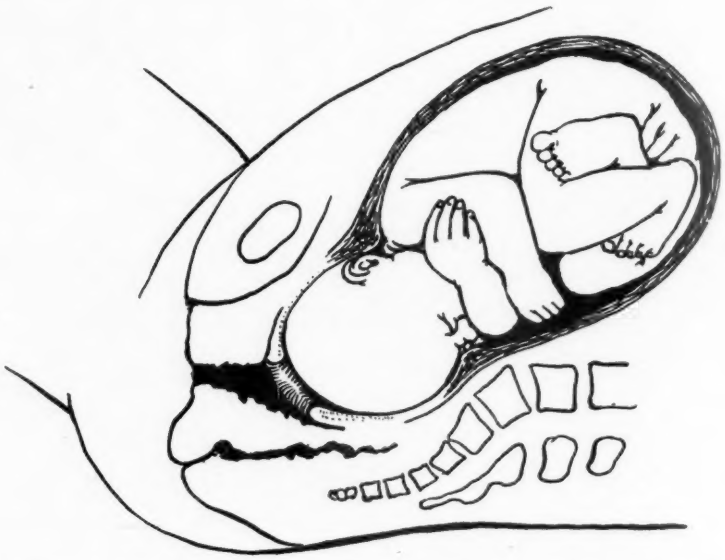

Fig. 6.—Cervix dilated 4 to 5 centimeters. Labor over thirty hours. Station of head slightly higher. Ready for delivery per vaginam.

Fortunately, the ease with which these cases may be delivered is in marked contrast to the difficulties and anxieties suffered by both the patient and doctor during the long hours of labor. This is easily explained when it is realized that in unobstructed ring dystocia only the contraction ring prevents the passage of the child, and therefore the only requisite to easy delivery is relaxation of the ring. With the condition of the cervix as just described, and the duration of labor well over thirty hours, the patient is prepared for delivery. The outer gate of the birth canal is opened with the episiotomy of choice, and the hand is carried deep into the vagina to iron out or stretch the posterior pelvic fascia and the underlying portions of the levator ani muscles. This is advisable, since the fetal head has not been forced against these structures to condition them for the passage of the child. The edematous cervix is now felt as a drape covering the most dependent portions of the presenting part. It does not require manual dilatation as one thinks of the term, because the cervix generally brushes aside by merely opening and separating the fingers of the operating hand. The latter is now carried upward posteriorly between the lower uterine segment (Fig. 7) and the fetal head for the purpose of making an accurate diagnosis of position, and also to determine the presence of any loops of cord below the ring. At this time the contraction ring is examined to ascertain what,

if any, effect the present degree of anesthesia is having upon its tone. If a loop of cord is not present in the lower uterine segment, a painstaking cephalic application with midplane forceps is made. It may now be desirable, or even necessary, to deepen the anesthesia. Delivery is then effected by careful and steady traction, assisted by gentle pressure on the fundus in the direction of the pelvic inlet. If a loop of cord is present in the lower uterine segment, making it almost impossible for the cord to escape pressure from the forceps' blade,

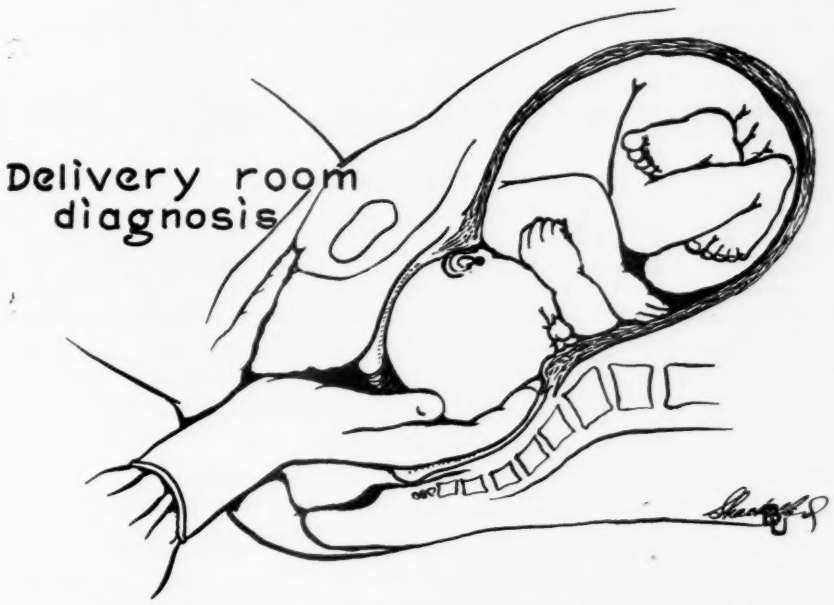

Fig. 7.—Under light anesthesia, hand is carried posteriorly between the fetal head and lower uterine segment to contact the ring. This is done to verify the diagnosis and to determine the method of delivery.

the writer prefers to lift the head up through the dilating or dilated ring, and complete the delivery by version and extraction. Adrenalin chloride will not dilate this type of ring. We tried it many times several years ago and always with the fingers trying gently to find a passage between the ring and the child's body. Ether and chloroform carried to the point of deep surgical anesthesia will relax it.

Summary and Conclusions

1. The confusion in nomenclature and origin of contraction rings appearing in current textbooks is deplored.

2. It is assumed that those rings generally reported are of the severe variety and occur with obstructed labors.

3. Reasons are given for the firm conviction that a milder variety, or subclinical and larger group occurs with otherwise unobstructed labors.

4. Maternal mortality, operative incidence, and fetal mortality, as reported in a collective review of the literature, are compared with similar figures obtained from treatment of a large series of subclinical or early contraction rings.

5. The incidences of contraction rings in several institutions in Houston, Texas, are given to show the variance due to awareness of this complication of labor.

6. Early rupture of the membranes is believed to be a predisposing factor in the development of uterine rings.

7. Temporary or functional rings are recognized.

8. Cardinal signs and symptoms of ring dystocia are given, and the development and diagnosis of these rings are depicted in diagrams.

9. The usual methods of delivery in association with ring dystocia are described.

The author wishes to express his sincere appreciation to Miss Ella May Schakelford, medical artist, Baylor University College of Medicine, for the drawings.

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THE PERSISTENCE OF THE GONOCOCCUS IN THE FEMALE ADNEXA

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THE persistence of the gonococcus in the female adnexa over a prolonged period of time in patients who previously suffered from gonococcal infections is still a controversial subject.

A report of a study of operative gynecologic material obtained from 24 patients by Studdiford, Casper, and Scadron[1] showed that 66.6 per cent of such cases yielded positive gonococcus cultures, despite the fact that none of the patients was in the acute stage of the disease. On the other hand, Curtis[2] states: "It has almost never been possible to obtain gonococci in cultures from thoroughly ground Fallopian tubes removed from patients who have been free from fever and leucocytosis for a period of more than ten days or two weeks. The Fallopian tube appears, therefore, not to be a focus for chronic gonorrheal infection."

It must be emphasized that the above results were obtained in patients who had not received either sulfonamide or penicillin therapy. The object of this study was to determine whether or not such findings are still valid in the light of present therapy.

The operative material of 65 hospitalized female patients suffering from acute or chronic adnexal disease was examined bacteriologically for the presence of the gonococcus.

In order to ascertain the presence or absence of a gonococcal infection, an average of three urethral and cervical cultures was taken from each patient prior to operation.

A correlation of previous history of gonococcal infection and bacteriologic findings on admission is shown in Table I.

TABLE I. HISTORY AND BACTERIOLOGIC FINDINGS OF 65 CASES WITH PELVIC INFLAMMATORY DISEASE ON ADMISSION

PREVIOUS HISTORY OF GONOCOCCAL INFECTION	NUMBER OF PATIENTS	CULTURES			
		URETHRA		CERVIX	
		POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
Denied	29		29		29
Admitted	22	10	12	20	2
Doubtful	14		14		14
Total	65				

The clinical diagnosis on admission is shown in Table II.

During hospitalization prior to operation, nine of the 45 women who had gonococcus negative urethral and cervical cultures received sulfonamide therapy.

TABLE II. CLINICAL DIAGNOSIS OF 65 PATIENTS ADMITTED TO THE GYNECOLOGICAL SERVICE AT BELLEVUE HOSPITAL

DIAGNOSIS	NO. OF PATIENTS
Chronic adnexal disease	26
Acute exacerbation of chronic adnexal disease	24
Pelvic abscess	3
Ruptured tuboovarian abscess	2
Fibromyoma and chronic pelvic inflammatory disease	7
Fibromyoma and chronic erosion of the cervix	1
Fibromyoma of the uterus	1
Degenerated fibroid	1
Total	65

Of the group of 20 gonococcus positive patients (in urethra and/or cervix), 10 became bacteriologically negative following sulfonamide therapy, two other patients were sulfonamide resistant, and two additional women responded to penicillin treatment prior to operation. The remaining six gonococcus positive cases (in urethra and cervix) received no treatment at all; nevertheless, two patients became spontaneously negative bacteriologically preoperatively. Consequently, there were only four untreated and two sulfonamide resistant patients who had gonococcus positive bacteriologic findings of the urethra or the cervix prior to their operation.

As a rule, no patient was operated upon before signs and symptoms of acute inflammation had subsided and the sedimentation rate had become normal.

Immediately following operation the majority of the patients received sulfonamide therapy or penicillin treatment in order to prevent possible complications of the infection. No spread of the infection occurred among these patients.

Method Used for the Bacteriologic Examination of Operative Material

The bacteriologic technique employed in examining the operative material was as follows: Culture material was taken from any exudate present in the abdominal cavity, particularly from the surface of the uterus or adnexa. By compressing the fimbriated end of the inflamed Fallopian tubes, it was occasionally possible to obtain culture material before surgical removal. As soon as the uterus or the adnexa or both had been removed, these organs were opened under sterile precautions. Culture material was taken as follows: (1) from the surface of the mucous membranes, (2) from the deeper layers by scraping the mucosa with a sterile knife, and (3) by dissecting pieces of tissue from the various layers of the organs. The culture material was collected with the aid of sterile swabs and then immersed into separate tubes containing 2 per cent peptone water.

The tubes containing the culture material were taken to the laboratory and cultured within two hours. Two plates were inoculated: one onto Peizer medium[3] and the other onto a medium* which has been proved to be equally good at our laboratory. Larger pieces of the operative tissue were further ground up into smaller particles and transferred onto the two different culture media. All the inoculated plates were incubated for the first twenty-four hours under 10 per cent carbon dioxide tension at 37° C., and for another twenty-four hours at the same temperature without carbon dioxide. The plates were

*This medium consists of 500 c.c. of Difco Bacto Proteose III Agar, 25 c.c. of citrated hemolyzed horse blood, 40 c.c. of ascitic fluid.

then read, and any suspicious gonococcus colonies were identified by smears, fermentation tests, lack of growth on plain agar, and absence of hemolysis on 5 per cent horse blood agar plates.[4]

Bacteriologic Findings of the Operative Material

The bacteriologic findings of the operative material of the 65 patients are as follows:

1. No gonococci were found in the operative material obtained from the 45 women whose cervical or urethral secretions were found to be gonococcus negative preoperatively.
2. No gonococci were found in the operative material of the 12 women whose cervical and urethral discharges were initially gonococcus positive, but who responded to sulfonamide or penicillin treatment prior to operation.
3. Gonococci were found in the operative material of only four of the eight initially gonococcus positive patients who received no treatment or did not respond to sulfonamide therapy prior to operation. Of these four patients whose operative material showed the presence of the gonococcus, three had not received any treatment, and one was resistant to sulfonamide therapy (Table III).

Comment

In our series the bacteriologic findings of operative material indicate that gonococci persisted in the female adnexa only in four of the eight untreated or treatment-resistant patients. In addition, negative bacteriologic findings in the operative material were obtained from 12 originally infected patients who were adequately treated preoperatively. These findings suggest the value of administration of adequate amounts of penicillin to patients with pelvic inflammatory disease prior to operation, particularly to those patients who have an antecedent history of gonococcal infection. This course as a routine procedure may diminish the danger of postoperative complications.

It is also noteworthy that somewhat more than 33 per cent of the operative material yielded no growth of any organism whatever on the special media used, despite the presence of an acute or chronic inflammatory process.

Illustrative Cases

The following two cases illustrate the histories and pre- and postoperative bacteriologic and pathologic findings of a gonococcus positive and a gonococcus negative case.

CASE 1.—C. L., a 20-year-old single Puerto Rican girl had repeated gonococcal infections. She was treated for gonorrhea with sulfonamides in Harlem Hospital in 1941. According to her history, ankle and toe joints were also affected at that time. She was admitted to Bellevue Hospital in 1943 for pelvic inflammatory disease and vaginal discharge. In March, 1944, she was treated with sulfathiazole in Bellevue Hospital because of gonococcal urethritis, cervicitis, and salpingitis. She was again admitted to Bellevue Hospital on Oct. 19, 1944, because of bilateral abdominal pain of twelve hours' duration, and a temperature of 100.2° F.

Examination.—There was tenderness and spasm on both lower quadrants. The cervix was posterior and firm. The uterus was of normal size, anterior, and tender on motion. There was a bilateral tender adnexal mass, 4 cm. in diameter. The cervix showed a cervicitis with bleeding erosion.

Diagnosis.—Acute exacerbation of chronic salpingitis, right and left tuboovarian abscesses.

TABLE III. BACTERIOLOGIC FINDINGS OF OPERATIVE GYNECOLOGIC MATERIAL REMOVED FROM EIGHT INFECTED, UNTREATED, OR TREATMENT-RESISTANT PATIENTS

CASE	DIAGNOSIS	BACTERIOLOGIC FINDINGS ON ADMISSION		THERAPY	RESULT OF THERAPY	DURATION OF PELVIC INFLAMMATORY DISEASE PRIOR TO ADMISSION	BACTERIOLOGIC FINDINGS PRIOR TO OPERATION		INTERVAL BETWEEN POSITIVE FINDINGS AND OPERATION (DAYS)	BACTERIOLOGY OF OPERATIVE MATERIAL				
		URETHRA	CERVIX				URETHRA	CERVIX		UTERINE CAVITY	RIGHT FALLOPIAN TUBE	RIGHT OVARY	LEFT FALLOPIAN TUBE	LEFT OVARY
1	Chronic adnexal disease, or ectopic pregnancy	Neg.	Pos.	None	—	About 5 weeks	Neg.	Pos.	7	—	Sterile	—	—	—
2	Acute exacerbation of chronic salpingitis	Neg.	Pos.	None	—	About 6 weeks	Spontaneous negative		34	—	—	—	Neg.	—
3	Acute exacerbation of chronic adnexal disease	Pos.	Pos.	None	—	Similar attack 3 years ago, acute exacerbation for 4 days	Spontaneous negative		32	—	—	—	Neg.	Neg.
4	Acute exacerbation of chronic salpingitis, right and left tuboovarian abscess	Pos.	Pos.	Sulfathiazole 12 Gm.	Resistant	1943, pelvic inflammatory disease—March, 1944, gonococcal salpingitis, acute salpingitis one day	Pos.	Pos.	11	—	Pos.	Pos.	Pos.	—
5	Pelvic inflammatory disease	Pos.	Pos.	None	—	About 5 months	—	Pos.	4	Pos.	Sterile	—	—	—
6	Acute exacerbation of chronic adnexitis	Pos.	Pos.	Sulfathiazole 12 Gm.	Resistant	Repeated attacks for 7 years, acute exacerbation for 2 days	Pos.	Pos.	3	—	Sterile	Sterile	Sterile	—
7	Pelvic inflammatory disease, bilat. pyosalpinx, tuboovarian abscess	Neg.	Pos.	None	—	Gonorrhea 3 months ago	Neg.	Pos.	57	—	Pos.	Neg.	Neg.	Neg.
8	Endocervicitis, subacute salpingitis, tuboovarian abscess	Pos.	Pos.	None	—	Episodes of adnexal inflammations for 7 years	Pos.	Pos.	16	—	Pos.	Pos.	Pos.	—

Positive = gonococcus present. Negative = gonococcus absent. — = no examination performed.

Therapy.—The patient received 12 Gm. of sulfathiazole, but remained positive on urethral and cervical cultures.

Operation.—Laparotomy was performed on Oct. 28, 1944, eleven days after the last gonococcus positive findings.

Findings.—The uterus was anterior and normal in size. The left tube was normal in size but tortuous and extruding pus from the fimbriated end. The right tube was enlarged to four to five times the normal size and was filled with pus. The ovary was enlarged three to four times the normal size, cystic, and adherent with the tube to the posterior aspect of the broad ligament. There were many adhesions of the intestines to the adnexa.

Operative Procedure.—A right salpingo-oophorectomy and a left salpingectomy was done. Five grams of sulfanilamide were sprinkled into the abdominal cavity.

Postoperative Course.—The postoperative course was essentially uneventful from the surgical point of view. The patient was given 100,000 Oxford units of penicillin, because here cultures taken on the sixth postoperative day were still gonococcus positive.

Laboratory Findings.—

Preoperative: Urethral and cervical cultures were gonococcus positive on October 11 and October 18.

Operative material: The cultures from the operative material from the right tubal abscess, right tube, right ovary, and left tube were positive for the gonococcus. One of the positive cultures from the left tube was obtained by squeezing out the tube before its removal.

Postoperative: Cultures taken on the sixth day after the operation were still positive for the gonococcus. After the patient was given 100,000 Oxford units of penicillin, her cultures became negative.

Pathologic Diagnosis.—Bilateral pyosalpinx with subacute follicular salpingitis, corpus luteum hematoma, and peritoneal adhesions.

Discharge.—The patient was discharged on the twenty-first day after the operation.

CASE 2.—E. B. (Hospital No. 28013-44), a 41-year-old white married woman with no history of previous gonococcal infection was admitted to Bellevue Hospital on June 18, 1944, because of abdominal pain in both lower quadrants of ten days' duration. She had been married for seventeen years, and had had three miscarriages in the first three years of her married life. In 1928, sixteen years ago, the patient was admitted to Roosevelt Hospital because of abdominal pain and fever; a pelvic abscess was opened by posterior colpotomy. In March, 1944, she had a similar attack of right lower abdominal pain with vaginal bleedings, lasting for about ten days; the condition improved after bed rest. For the last five years she suffered from diabetes mellitus.

Examination.—On admission there was tenderness and an increased resistance in the right lower abdominal quadrant. The cervix was anterior, closed, and firm. The fundus uteri could not be felt. There was a 12 cm. tender, cystic mass, filling most of the pelvis, extending deep into the cul-de-sac, and rising up to two fingers above the symphysis.

Diagnosis.—Right tuboovarian abscess, diabetes mellitus.

Therapy.—No sulfonamide or penicillin therapy was given.

Operation.—Laparotomy was performed on Aug. 14, 1944, fifty-six days after admission and after gonococcus negative findings.

Findings.—The uterus was anterior, normal in size. The ovaries were densely adherent to the posterior aspect of the broad ligament. Otherwise they were normal except for fibrosis. The left tube was thickened to twice the normal size, with a sealed ampulla and adherent to the broad ligament. The outer third of the right tube formed a 6 cm. cystic mass, filled with pus.

Operative Procedure.—A supracervical hysterectomy and bilateral salpingo-oophorectomy was done.

Postoperative Course.—The postoperative course was uneventful.

Laboratory Findings.—

Preoperative: Urethral and cervical cultures were negative.

Operative material: Five cultures from both tubes and ovaries of the operative material were gonococcus negative.

Pathologic Diagnosis.—Proliferation of endometrium uteri. Bilateral subacute salpingitis with pyosalpinx. Right cystic hydatid of Morgagni. Unclassified cysts of right ovary. Peritoneal adhesions.

Discharge.—The patient was discharged on the twenty-seventh postoperative day.

Summary and Conclusions

1. Operative material from 65 hospitalized female patients suffering from acute and chronic adnexal disease was examined bacteriologically for the presence of the gonococcus.

2. Forty-five women with adnexal disease had persistent gonococcus negative bacteriologic findings, both pre- and postoperatively, and also in their operative material.

3. The remaining 20 cases were gonococcus positive preoperatively. Twelve of these were successfully treated preoperatively and showed gonococcus negative bacteriologic findings in their operative material.

4. Of the remaining eight patients, two became gonococcus negative spontaneously, and yielded negative bacteriologic findings on their operative material.

5. Of the remaining six, two patients were resistant to sulfonamide therapy, the operative material of one of these cases was gonococcus positive. Of the remaining four cases, all of which were positive preoperatively, only three yielded positive bacteriologic findings.

6. All cases which were successfully treated for their gonococcal infection proved to have gonococcus negative bacteriologic findings in their operative material.

7. The bacteriologic findings of this study indicate that the persistence of the gonococcus in the female adnexa is limited to untreated or treatment-resistant patients.

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INTRAPARTUM FEVER: A PRELIMINARY STUDY

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IN RECENT years the clinical importance of intrapartum fever has not received the attention it deserves. Except for older European studies[1-10, 13-16, 18, 20] little effort has been made to investigate this serious complication of parturition. Previous observations have demonstrated that the appearance of fever during labor alters considerably the maternal and fetal prognosis (Table I).

TABLE I. INTRAPARTUM FEVER: REVIEW OF LITERATURE

AUTHOR	YEAR	TOTAL NUMBER OF DELIVERIES	TOTAL NUMBER OF INTRAPARTUM FEVERS	INCIDENCE OF INTRAPARTUM FEVERS (%)	MATERNAL MORBIDITY (38°+) (%)	MATERNAL MORTALITY (%)	INFANT MORTALITY (%)	OPERATIVE INCIDENCE (%)
Odell and Plass	1926-1942	15,826	187	1.1	42.8	8.0	36.9	42.2
Anderson	1937	11,075	207	1.9	63.8	7.7	33.4	48.8
Hilgenburg	1931	3,558	150	4.2	54.0	4.0		50.0
Matere	1930		61		52.2	9.8	41.0	61.1
Siegert	1928		87		48.63			
Lankovitz	1924-1928	22,127	290	1.3	30.0	1.0	32.8	(low)
Zangemeister	1915-1927	14,499	538	3.7	49.0	7.6	35.0	49.8
Zangemeister*	1925-1927		100		41.0	0	33.5	50.0
Henkel	1913-1921	3,240	117	3.6	38.0	3.4	29.9	38.3
Warnekros	1913		151			4.0		
Ihm	1897-1903	7,554	200	2.7	41.5	4.0		50.0
Ahlfeld	1893	3,000	62		65.5	6.2		49.0
Glockner	1891	1,000	211	21.1	32.7	7.1	35.5	
Winter†			53	62.0	8.0	35.0		
Wichman†			110	14.0	7.0			
Rhode†		4,279	90	2.1				
Liepmann†		1,212	126	10.4				
Kronig†				2.9				

Values in the various percentage columns should not be subjected to direct comparison because of the different criteria employed in compiling the data.

*Second series of cases.

†From Zangemeister and Weilck.[1]

According to most authors[1-11, 13, 15, 16, 19, 20] the diagnosis of intrapartum fever is established if the temperature reaches 100.4° F. (38° C.). Confusion over etiology and proper treatment has led to a diversity in therapy. Both operative and conservative managements have been recommended. The present study was made to investigate our experience with febrile labors and to suggest acceptable treatment.

Material

In the period July 1, 1926, to July 1, 1942, at the University Hospitals, there were 187 labors attended with fever.* Only those patients giving birth to children weighing over 1,500 grams have been included. Patients with afebrile uterine infections† have not been considered.

*100.4° F. or 38° C.

†Putrid amniotic fluid without fever.

Incidence

The incidence of intrapartum fever was 1.2 per cent, 1 in 85 deliveries. The higher incidence in previous reports (Table I) is best explained by (a) inadequate obstetric techniques and lack of prenatal care in the late nineteenth and early twentieth centuries,[2, 3, 4, 10, 16] (b) the inclusion of the influenza epidemic of 1918 to 1919,[1, 15] (c) the inclusion of patients with afebrile genital infections,[1] and (d) the use of 35 cm. instead of 1,500 Gm. as the dividing line between late abortion and premature labor.[1-11, 13-16, 19, 20] The incidence of intrapartum fever in most modern clinics probably lies between 1 and 2 per cent.

Etiology

Intrapartum fever may be due to metabolic, extragenital, or genital causes (Table II). Dehydration fever has long been a recognized clinical entity. Pride, et al.[21, 22] have demonstrated ketosis (ketone bodies in urine) and lower CO_2 combining power in prolonged labors. Vomiting and reduced caloric intake commonly lead to the development of ketosis. A steadily decreasing CO_2 combining power may be evidence of lactic acid accumulation within the tissues.[21, 22] The older idea[2, 3] that fever in prolonged labor may be due to muscular exertion and thus be comparable to that detected in long distance runners is not inconsistent. Intrapartum fever due to dehydration (inanition) develops late in labor. The temperature seldom rises above 102° F., and falls after the administration of fluids and dextrose. Toxic symptoms (chills, malaise, etc.) and evidence of genital or extragenital infection are absent. If the patient's temperature is taken frequently during labor these asymptomatic fevers will not be overlooked.

Several extragenital sources of intrapartum fever have been reported. The pyrexia in eclamptics is generally considered central in origin.[23] However, placental infection[17, 18] has been described in eclamptic patients, particularly when labor has been surgically induced. Intrapartum fevers due to respiratory, urinary, and contagious diseases may occur (Table II).

Warnekros,[6, 7] Slemons,[11, 12] and Siddall[26] demonstrated bacteria within the amnion, subamnion, and intervillous spaces. Seventy per cent of positive maternal blood cultures were reported in patients with intrapartum genital infections.[6, 7] Although later investigation[1] failed to confirm such a high rate of bacteremia, it is obvious that, in the presence of placentitis, the maternal and fetal circulations can easily be invaded from the adjacent intervillous spaces. Depending upon various factors (type and virulence of the organisms, resistance of the host, and adequacy of cervical drainage) amnionitis may or may not produce a febrile response and foul-smelling amniotic fluid. In the absence of fever, there may be some doubt concerning the pathogenic character of the invaders. Fever, when present, is commonly accompanied by chills, malaise, and other toxic manifestations. Uterine inertia is usually present.

Rarely, the uterus may be tender and tense from gas accumulation; percussion over the fundus may elicit tympany ("balloon" sound[1]). Genital infections may occur in combination with dehydration and other extragenital sources of fever (Table II).

TABLE II. THE RELATION OF THE ASSIGNED CAUSE OF THE PYREXIA TO MATERNAL AND FETAL COMPLICATIONS

	DEHYDRATION		EXTRAGENITAL SOURCE		GENITAL INFECTION		COMBINED CAUSES	
	NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT
Total	39	20.8	19	10.2	66	35.3	63	33.7
Maternal deaths	0	0.0	7	36.8	5	7.5	3	4.7
Child, death	0	0.0	8	42.2	28	42.4	33	52.4
Child, asphyxia	6	17.9	2	10.5	29	43.9	32	50.8
Child, infection	3	7.7	1	5.3	6	9.0	8	12.7
Febrile puerperium	1	2.5	11	57.9	35	53.1	39	61.9
Maximum intrapartum fever—								
100.4-101	25	64.2	5	26.3	23	34.8	18	28.6
100.1-102	13	33.3	7	36.8	26	39.4	22	34.9
Over 102	1	2.5	7	36.8	17	25.8	23	36.5

"Combined causes" represent those cases with genital infections plus one or more extragenital sources of fever. "Extragenital sources" include eclampsia, ten; urinary tract infection, four; pneumonia, three; infectious diarrhea, one; and measles, one.

There are several other factors associated with the development of intrapartum fever. As high as 50 per cent of intrapartum fevers have been reported[13] as occurring in patients with prematurely ruptured membranes.* Prolonged labor (over thirty hours' duration) has been similarly associated with fever,[27] probably the result of dehydration and numerous rectal (or vaginal) examinations.† The effects of pre-existing genital infection (condylomas, Bartholinitis), poor pregnancy hygiene, and excessive vaginal manipulation[20] are self-evident. The high percentage of toxemic patients in this series may be related to necessary induction of labor (artificial rupture of the membranes or bag induction).

Maternal Morbidity

A high postpartum morbidity rate is to be expected in patients with intrapartum fever, particularly of genital origin. Operative delivery is often deemed necessary because of uterine inertia; and the pre-existing infection, as well as the trauma of operation, contributes to the development of puerperal sepsis. Patients with eclampsia, and with fevers of respiratory and urinary tract origin are likewise prone to develop puerperal infections, although those with dehydration fever are usually free from sequelae (Table II). Eighty women (45.9 per cent) in this series were febrile after delivery, and 35 had relatively serious puerperal complications‡ (Table III). The bacteriologic findings were di-

*In this series 47.6 per cent had prematurely ruptured membranes.

†In this series 73 patients (41 per cent) had prolonged labors.

‡Parametritis, fifteen; pneumonia, eleven; peritonitis, four; septicemia, four; and thrombophlebitis, one.

TABLE III. FEBRILE PUERPERAL COMPLICATIONS

	PATIENTS	
	NUMBER	PER CENT
Endometritis*	70	37.4
One-day fever	28	14.9
Parametritis	15	8.0
Pneumonia	11	5.8
Pyelitis	10	5.2
Peritonitis	4	2.1
Septicemia	4	2.1
Thrombophlebitis	1	0.5

*Fever lasting more than one day and not associated with a demonstrable extragenital cause of fever or with evidence of pelvic infection outside the uterus. Diagnosis made by exclusion.

The total of these percentages is greater than the reported incidence of febrile puerperium because some patients fell into more than one category.

TABLE IV. MATERNAL BACTERIOLOGIC FINDINGS

ORGANISM	CERVICAL CULTURE	URINE CULTURE	BLOOD CULTURE
Total	26	14	24
No growth	0	0	20
E. coli	5	11	0
Gonococcus	4	0	0
Staphylococcus aureus	1	1	1
Diphtheroid	2	0	0
Staphylococcus albus	7	1	0
B. hemolytic streptococcus	5	0	3
Alpha hemolytic streptococcus	7	0	0
Nonhemolytic streptococcus	3	0	0
Anaerobic hemolytic streptococcus	2	0	0
Bacteria pyocyanase	1	1	0

Death occurred in all patients with positive blood culture. Cervical cultures occasionally revealed more than one organism.

versified but death occurred in all patients with positive blood cultures (Table IV).

Maternal Mortality

The gross maternal mortality rate was 8.0 per cent (15 patients), but eclampsia[3] and extragenital lesions (pneumonia, two; and arsenical encephalitis, two) contributed almost one-half. (See case reports for review of all maternal deaths.) According to the standards of the Division of Maternal Welfare of The Bureau of Vital Statistics, the maternal deaths would be classified as follows:

Nonobstetric deaths	4
Albuminuria and eclampsia	3
Shock and accidents of labor	3
Puerperal sepsis	3
Hemorrhage	1
Thrombophlebitis and embolus	1

Intrapartum fever in a patient with eclampsia or severe respiratory infection is often followed by postpartum shock, pneumonia, sepsis, and death. In this series postpartum shock was observed in five patients, of whom four expired. The specter of death is constantly before those with febrile labors of genital origin, particularly if difficult operative delivery is necessary.

Infant Mortality and Asphyxia

High stillbirth and neonatal death rates have been constant findings in women with intrapartum fevers (Table I). Prematurity is responsible for some

deaths (Table V) but infected amniotic fluid also unfavorably alters the prognosis for the infant. Fetal pneumonia[24] from aspiration of the infected fluid has been described; the pneumonic process is frequently limited. According to Potter[24]:

"Pneumonia may be present in stillborn or liveborn infants. It is rarely either distinctly bronchial or lobar in distribution but usually entails diffuse involvement of irregularly scattered alveoli. It is of intrauterine origin since squamous cells from inspired amniotic fluid are frequently associated with the polymorphonuclear leukocytes in the alveoli. Little or no fibrin is present and areas of hemorrhage of the lungs, especially when these occur in partially atelectatic areas, may produce the same appearance. Sections of the lungs should be examined microscopically in all cases in which pneumonia is suspected, before a positive diagnosis is made. In fact, a positive statement as to the presence or absence of pneumonia in a stillborn or a newly born infant can rarely be made except on microscopic examination."

TABLE V. SUMMARY OF AUTOPSY FINDINGS IN 48 INFANTS*

	ANTEPARTUM DEATHS INFANTS		INTRAPARTUM DEATHS INFANTS		NEONATAL DEATHS INFANTS	
	NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT
Total (autopsied)	6		31		11	
Prematurity	3	50.0	6	19.7	1	9.0
Maceration	4	66.6	5	16.2	0	0.0
No significant lesion	2	33.3	9	29.1	1	9.0
Septicemia	0	0.0	1	3.2	1	9.0
Subcutaneous abscess	0	0.0	0	0.0	1	9.0
Intracranial hemorrhage						
Slight	0	0.0	5	16.6	0	0.0
Severe	0	0.0	7	23.3	7	63.6
Marked atelectasis	6	100.0	31	100.0	0	0.0
Miscellaneous	3	50.0	0	30.0	1	9.0
Total available lung sections reviewed by E. Potter	2		24		10	
Fetal pneumonia	1	50.0	12	50.0	6	60.0

*There were many multiple diagnoses.

Among 19 cases with evidence of fetal pneumonia (E. Potter), eight had been previously described by other pathologists as showing no significant lesions. The miscellaneous group included fetal asphyxia, two; intra-abdominal hemorrhage, four; hydrocephalus, one; meningomyelocele, one; anencephalus, two; erythroblastosis fetalis, one; congenital lues, one; and extensive hemorrhage into the neck, one.

The histologic sections available in this series were reviewed by Potter, who found pneumonia in 50 per cent of the stillborn and in 60 per cent of the neonatally dead infants (Table V). Other investigations[6, 7, 11, 12] suggest placental invasion and subsequent fetal septicemia as the chief cause of death. The lack of significant findings in some autopsied infants is puzzling (Table V). Fulminating fetal septicemia may cause death so quickly that there is insufficient time for anatomic changes to develop. On the other hand, the bacterial invasion of the blood may represent merely a harmless bacteremia. The fetus must depend upon the mother for immunologic protection. If maternal defenses are inadequate the fetus has little chance to escape a blood stream infection.

Recently, two patients developed intrapartum fever with signs of genital infection. The first was spontaneously delivered of a stillborn infant, the culture of whose heart blood disclosed alpha hemolytic streptococci. The same or-

ganism was recovered from the child's lung, the placenta, and the mother's cervix. Microscopic examination of the lung revealed no pneumonic process. The second patient was delivered of a living infant after Dührssen's incisions by midforceps extraction because of uterine inertia. Blood culture from the infant (fontanel puncture) disclosed hemolytic staphylococcus aureus, the organism being recovered from the infant's groin and the mother's cervix. In spite of the bad prognosis of a staphylococcus septicemia, the prompt administration of sulfathiazole (commenced immediately after birth in anticipation of such a complication) was followed by complete recovery.

Whether aspiration pneumonia and septicemia from placental invasion are independent or dual causes of fetal (or neonatal) death in genital infections of the parturient will be the primary objective of future investigation. In eclampsia the high infant mortality rate has been attributed to prematurity and anoxia from hypnotic drugs,[23] or to traumatic delivery resulting in severe intracranial damage (Table V). While evaluation of the effect of the ma-

TABLE VI. FACTORS AFFECTING CHILD DEATH RATES

	TOTALS	ANTEPARTUM DEATHS INFANTS		INTRAPARTUM DEATHS INFANTS		NEONATAL DEATHS INFANTS	
		NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT
Child deaths	69	10	14.5	41	59.4	18	26.1
Operative delivery	75	5	6.6	25	33.3	9	12.0
Height of intrapartum fever—							
100.4°-101° F.	73	3	4.1	10	13.7	4	5.4
101.1°-102° F.	67	1	1.5	13	19.4	6	8.9
Over 102° F.	47	6	12.8	18	38.3	8	17.0
Prematurity (under 2,500 grams)	38	4	10.5	9	23.6	4	10.5

The height of the intrapartum fever (possibly a measure of the virulence of the infecting organisms) correlated directly with the fetal and neonatal death rates.

ternal pyrexia is problematic, the height of fever during labor, a measure of bacterial virulence, and the resistance of the organism, shows a direct relationship with the fetal death rate. This suggests infection as an important cause of death (Table VI).

Asphyxia is frequently encountered in infants delivered from febrile parturients. Genital infection, prolonged labor, and operative delivery were the most significant factors influencing the incidence of asphyxiation. Asphyxia neonatorum (of some degree) was encountered in 121 infants (64.7 per cent). It has been suggested that toxins transmitted through the placenta or absorbed from the respiratory tract may be important causes of fetal asphyxia during febrile labors. On the other hand, fetal asphyxia is frequently the result of intracranial injury in children subjected to prolonged or operative deliveries.

Therapeutic Considerations

Any approach to the treatment of intrapartum fever must include both diagnostic and therapeutic aims. Early diagnosis of the cause of fever during labor alters prognosis and management. In general, the necessary diagnostic procedures are relatively simple. Urinalysis will detect evidence of urinary tract infection and of ketosis. Physical examination will reveal upper respira-

tory infection or exanthemas. The uterus should be carefully palpated for tenderness, consistency, and tympany. A foul odor about the genitals suggests infected amniotic fluid even before expulsion of the child. Adequate bacteriologic investigation (cervical, throat, urine, and blood cultures) is important, especially in patients exhibiting chills, high fever, and toxicity.

The administration of intravenous fluid, especially dextrose solution, is recommended for its general effect and to evaluate the role of dehydration in the development of the fever. Pride, et al.[21, 22] recommend 4.0 Gm. of sodium bicarbonate by mouth in prolonged labors in the belief that postpartum shock may be prevented by reducing the acidosis. Except in severe respiratory infections, adequate sedation with morphine is indicated to conserve maternal strength. Chemotherapy with penicillin or sulfonamides is of definite value in serious infections. The maternal morbidity and infant mortality rates incident to febrile labors can be reduced by intramuscular penicillin or by intravenous sodium sulfathiazole before delivery. To test the efficacy of administering sulfonamides during labor, two mothers with uncomplicated labors were given 5.0 Gm. of sodium sulfathiazole intravenously two hours forty-six minutes, and three hours twenty-five minutes before delivery. The respective blood sulfathiazole levels of the mother and child at the time of delivery were 7.8 mg. per 100 c.c., of blood and 6.0 mg. per 100 c.c. in the first case, and 5.8 mg. per 100 c.c. of blood and 6.0 mg. per 100 c.c. in the second case.

TABLE VII. INDIVIDUAL BACTERIOLOGIC FINDINGS

NAME	BLOOD CULTURE	MOTHER CERVICAL CULTURE	INFANT BLOOD CULTURE	PLACENTAL CULTURE	AUTOPSY FINDINGS
D. G.	No growth	Beta hemol. strep. (Lancefield B)	Beta hemol. strep. (Lancefield B)	Not done	No significant finding
R. C.	No growth	Alpha hemol. strep.	Alpha hemol. strep.	Alpha hemol. strep.	†No significant finding
M. L.	No growth	Staph. aureus, alpha hemol. strep.	Staph. aureus, alpha hemol. strep.	*Overgrown	No significant finding
R. B.	No growth	Staph. albus	Hemol. staph. aureus	Not done	Discharged alive
K. J.	No growth	Alpha hemol. strep. and hemol. staph. aureus	No growth	E. coli	Discharged alive

*The culture was overgrown with pseudomonae pyocyanea often inhibitory to the growth of pathogens.

†No significant anatomic lesion other than atelectasis was found at autopsy.

Note the similarity of the bacterial flora from fetal blood, maternal cervix and placenta.

It is dubious if intrapartum fever constitutes an acceptable indication for operative delivery, and previous investigations[1, 14, 19, 20] have consistently stressed this doubt. With the exception of older reports, a high operative incidence was uniformly associated with high maternal mortality and morbidity rates (Table I). Although operative intervention may save some infants, the accoucheur hesitates to subject infected maternal tissues to traumatic procedures in face of the probability that future pregnancies will be safely com-

pleted. Maternal indications for operative delivery (eclampsia, cardiac disease, and uterine inertia) may be approached conservatively. When operative delivery becomes necessary it should be performed with as little trauma to maternal and fetal tissues as possible. Extraperitoneal cesarean section may offer a better solution for some prolonged, infected labors than Dührssen's incisions followed by difficult forceps extractions. This is particularly true of those patients with "dystocia dystrophy syndrome," emphasized by DeLee. Women with intrapartum fever are apparently particularly predisposed to certain complications of labor. In this series, postpartum hemorrhage (over 600 c.c.) occurred in 21 patients; manual removal of the placenta was necessary on three occasions. The presence of these complications in febrile labors amplifies the dangers already present inasmuch as invasion of the birth canal may become necessary. Prior to the introduction of penicillin and the sulfonamides, manual removal of the placenta[1] after a febrile labor of genital origin often resulted in maternal death from sepsis. Probably the vigorous use of the newer antibiotics significantly reduces this risk. In febrile labors with genital infections, episiotomy wounds and perineal lacerations sutured with catgut are apt to disrupt; silkworm gut[25] has been recommended, since drainage is simplified after such repairs.

Grave significance has been attached to continued fever in the early puerperium[1, 19] since it may indicate a fulminating puerperal infection. Penicillin, sulfonamides, transfusions, and efficient nursing care constitute the basis for intelligent therapy. Attention should obviously be directed to the possibility of an extragenital cause of fever, and proper diagnostic procedures should be employed to clarify the clinical picture.

Infant pneumonia and bacteremia in the neonatal period are common, particularly in the presence of maternal genital infection with amnionitis. Penicillin or sulfonamide therapy commenced immediately after birth will save some infants. Recently, sulfathiazole (1½ grains per pound weight per twenty-four hours) was successfully employed in an infant with staphylococcus bacteremia. Penicillin should prove even more effective. Other neonatal infections (conjunctivitis, impetigo, and subcutaneous abscesses) occur and early adequate treatment must be instituted.

Case Reports

Case 1.—(E.-9990.) M. G., aged 39 years, para v, gravida ix, was admitted Feb. 6, 1931, approximately eight months pregnant, in labor with an upper respiratory infection and a temperature of 103.6° F. After a short labor a 2,200-gram stillborn infant was delivered spontaneously. Immediately, postpartum signs of pneumonia appeared and death occurred twenty-eight hours after delivery. Hemolytic streptococci were recovered from blood taken just before and after delivery. Autopsy was refused; streptococcic septicemia was the probable cause of death.

Case 2.—(F-3815.) M. K., aged 31 years, para 0, gravida i, was admitted May 17, 1931, at term. She was irrational, with a pulse rate of 150 beats per minute, temperature 102° F., absence of fetal heart sounds, three plus albuminuria, edema of fundi, and fully dilated cervix. A 4,225-gram stillborn infant was extracted with forceps. The amniotic fluid was infected and foul. Shock,

fever, and pulmonary congestion developed in the immediate puerperium and death occurred on the ninth postpartum day. Blood cultures were negative. Autopsy was refused.

CASE 3.—(F-10567.) L. W., aged 30 years, para iii, gravida iii, was admitted Jan. 7, 1932, near term. Shortly afterward, sharp, continuous, lower abdominal pain and temperature of 101° F. developed. Rectal examination revealed a firm, orange-sized mass behind the cervix; a 2,750-gram living infant was delivered by cesarean section. Peritonitis was present at operation and subtotal hysterectomy was performed. The patient expired on the third postoperative day of peritonitis. At autopsy an adenocarcinoma of the sigmoid and generalized peritonitis were found.

CASE 4.—(H-19.) L. G., aged 40 years, para iv, gravida vi, was admitted Jan. 2, 1933, in labor with a respiratory infection, cough, hemoptysis, and fever of 102° F. A 2,958-gram living infant was delivered spontaneously after a short labor, but the patient expired eighteen hours post partum from pneumonia. Autopsy was refused.

CASE 5.—(M-5040.) H. C., aged 20 years, para 0, gravida i, was admitted in coma on Oct. 11, 1935, seven months pregnant. A convulsion had occurred five hours prior to admission. The temperature was 102° F., blood pressure 155/90, fetal heart sounds were absent. After artificial rupture of membranes (releasing 6,000 c.c. amniotic fluid), manual dilation of the cervix and internal podalic version, a 2,180-gram stillborn, anencephalic infant was extracted. Cyanosis and pulmonary consolidation developed immediately and death occurred forty-eight hours after delivery. Autopsy disclosed bilateral, confluent, lobar pneumonia and infarction of the anterior lobe of the pituitary.

CASE 6.—(M-426.) M. T., aged 31 years, para 0, gravida i, was admitted July 14, 1936, approximately eight and one-half months pregnant with pyelitis. After artificial rupture of the membranes, a 2,578-gram living infant was extracted with forceps. The temperature reached 102° F. during labor. Anemia, edema, cyanosis, dyspnea, and delirium complicated the puerperium, and the patient died on the twenty-fifth postpartum day. Autopsy disclosed pelvic thrombophlebitis and pulmonary infarction.

CASE 7.—(P-8969.) M. S., aged 39 years, para viii, gravida ix, was admitted Jan. 21, 1937, approximately eight and one-half months pregnant with an upper respiratory infection, anemia, and fever of 102.8° F. A 3,650-gram stillborn, macerated infant was extracted with forceps after a short labor. Cyanosis, pneumonic consolidation, high fever, and delirium followed delivery, and death occurred on the fourth postpartum day. No autopsy was granted.

CASE 8.—(E-3072.) E. M., aged 24 years, para ii, gravida iv, was admitted with latent syphilis Oct. 2, 1937, at term. After the fourth injection of neoarsphenamine, arsenical encephalitis developed. Labor commenced spontaneously the next day. A 2,588-gram living infant was extracted with forceps after maternal death. The temperature rose to 105.6° F. just before death. Autopsy disclosed edema of the brain, fatty metamorphosis of the liver, and pulmonary edema.

CASE 9.—(38-21502.) E. C., aged 43, para xii, gravida xiv, had elective premature artificial rupture of membranes at term. During a latent period of four days. Fever of 102.0° F. developed and the fetal heart sounds disappeared. After a short labor a 3,690-gram stillborn infant was delivered. There was a postpartum hemorrhage of 800 cubic centimeters. The ensuing febrile course

progressively worsened and the patient died on the fifteenth postpartum day despite energetic chemotherapy. Blood culture revealed hemolytic streptococci; autopsy showed generalized peritonitis and acute endocarditis.

CASE 10.—(38-24611.) R. H., aged 40 years, para vi, gravida vi, was admitted July 26, 1938, at term. After artificial rupture of membranes and a latent period of twenty-four hours, a 3,218-gram living infant was delivered spontaneously following a short labor. One hour prior to delivery a chill and temperature of 101.8° F. appeared. Shock, anuria, cyanosis, sepsis, and delirium followed delivery and death occurred on the thirteenth postpartum day. Blood cultures were negative. No autopsy was granted.

CASE 11.—(38-29937.) B. W., aged 34 years, para viii, gravida ix, was admitted in coma on Oct. 25, 1938, approximately seven months pregnant. Four convulsions and hematuria had been noted prior to admission. Labor commenced spontaneously and a 2,375-gram stillborn infant was delivered spontaneously after a short labor. Coma, pulmonary edema, and fever (105° F.) persisted, and death resulted forty-eight hours after delivery. Autopsy was refused.

CASE 12.—(39-7131.) E. L., aged 17 years, para 0, gravida i, was admitted with latent syphilis on June 9, 1939, approximately eight months pregnant. Following the tenth dose of neoarsphenamine, nausea, vomiting, and fever (101.4° F.) developed. A 2,420-gram living infant was delivered spontaneously after a short labor. Cough, hemoptysis, fever (105.6° F.), and leucopenia developed and death occurred on the first postpartum day in spite of energetic treatment. Hemolytic staphylococci were recovered from sputum and blood. Autopsy disclosed acute pulmonary edema, lobular pneumonia, hemolytic staphylococcus aureus septicemia and agranulocytosis.

CASE 13.—(38-18243.) R. S., aged 21 years, para ii, gravida iii, was admitted on May 27, 1940, at term. After artificial rupture of the membranes a transverse presentation developed which external manipulation failed to correct. Following this, the fetal heart sounds disappeared, and the temperature reached 101.6° F. After fifty hours of labor a 3,765-gram stillborn infant was delivered by cesarean hysterectomy. Cough, abdominal distention, fever (104.4° F.) and delirium developed during the puerperium, and death occurred on the tenth postoperative day. Beta hemolytic streptococci were recovered from the cervix, although blood cultures were negative. No autopsy was granted. Microscopic sections of the uterus showed no infection.

CASE 14.—(41-1862.) E. G., aged 20 years, para 0, gravida i, was admitted in coma on Feb. 8, 1941, approximately nine months pregnant. Six convulsions had occurred prior to admission. Examination disclosed a temperature of 100.4° F., four-plus albuminuria, and blood pressure of 220/106. After artificial rupture of the membranes and a short labor, a 2,800-gram stillborn infant was extracted (breech). Coma, fever, and convulsions persisted, and death occurred on the first postpartum day. Autopsy showed pulmonary congestion and edema, pleural effusion, and peripheral necrosis of the liver.

CASE 15.—(40-3592.) M. G., aged 27 years, para v, gravida ix, was admitted on Aug. 29, 1941, with vaginal bleeding at term in labor. The admission temperature was 102.3° F. A 3,500-gram stillborn infant was delivered spontaneously after a short labor. Bleeding and shock followed delivery. After supportive transfusions and a uterine pack failed to control hemorrhage, subtotal hysterectomy was performed ten hours after delivery. Death occurred on the first postoperative day. No autopsy was granted. Microscopic sections of the uterus disclosed acute suppurative endo- and myometritis and examination of placenta supported the clinical impression of placenta previa.

Summary

Fever during labor may be due to dehydration, extragenital disease, or birth canal infection. The last is diagnosed by excluding the other two, or by the discharge of foul material from the tract. The primary lesion in infections of the genital tract is an amnionitis (placentitis) which subjects both the mother and the child to serious sequelae. In the mother, puerperal infection frequently develops and may be fatal, while aspiration pneumonia and septicemia by direct extension into the placental vessels constitute the chief risks to the child. In this series of 187 febrile labors, 129 presented evidence of birth canal infection alone or in combination with an extragenital factor. In the latter group, eight mothers and sixty-one infants died, mortality rates of 6.2 per cent and 46.9 per cent, respectively. Dehydration fever was followed by no maternal or fetal deaths, but pyrexia of extragenital origin (no evidence of uterine infection) led to a maternal death rate of 36.8 per cent and a fetal mortality rate of 42.2 per cent.

Treatment of dehydration fever and of extragenital diseases followed usual lines. On the other hand, therapy of intrapartum birth canal infections has been significantly and favorably altered by recognition of the dangers involved and by the use of the newer antibiotics, the sulfonamides, and penicillin, prophylactically and curatively.

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CONTINUOUS SPINAL ANALGESIA IN CESAREAN SECTION*

Its Advantages, Technique, and an Analysis of Three Hundred Cases

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THE administration of regional or local analgesics for operative procedures has gained increasing prominence in the past few years and, with improvements in technique and drugs, their use should supplant, in a large measure, the older types of general anesthetic agents now employed.

Cesarean section[1] requires a more careful selection of anesthesia than any other surgical obstetric procedure. Here, consideration must be given to the child in utero as well as to the mother, and an anesthetic must be used that will be satisfactory to both. The ill effects of various drugs and inhalation anesthesia on the unborn child have long been recognized. The marked narcosis of babies delivered by these methods has been one of the highest causes of fetal mortality. Realizing this deleterious effect, it has become the object of obstetricians, when cesarean section is indicated, to use an anesthetic agent which will have the least possible effect upon the baby.

With the advent of spinal anesthesia, it was thought that a method had been found that would be safe for the baby, but at that time only drugs of high toxicity were available and large doses were injected. As a consequence, numerous deaths occurred before the operation began. As a result of this maternal mortality, single dose spinal anesthesia was given up in most of the clinics throughout the country and local infiltration was used as safest for the mother and child. However, not every patient was suitable for this type of anesthesia and inhalation agents were used in a high percentage of cases. Since the introduction of continuous or fractional spinal by Lemmon,[2] in 1939, and with the use of less toxic drugs, its safety has been well demonstrated. The application of this method to cesarean operations followed, in that it offered an ideal method of safety and controllability which is so necessary for the operation.

Definition.—Analgesia is defined as the production of an insensibility to pain and is used here instead of the common term anesthesia, which usually denotes complete absence of sensation. Thus continuous spinal analgesia means only a loss of sensibility to pain and the complete retention of consciousness, produced by the injection of a drug into the subarachnoid space.

A. *Advantages.*—

1. The safety of continuous spinal analgesia lies mainly in the administration of smaller initial doses instead of the previous one-injection method. This is because the most dangerous period of spinal analgesia is within the first thirty minutes after injection. With the giving of a small initial dosage of the drug any untoward toxic symptoms will be minimal, and with the needle in the subarachnoid space, most of the drug can be rapidly withdrawn by removing several cubic centimeters of cerebrospinal fluid.

2. The controllability of continuous spinal analgesia is of paramount importance in cesarean section. A very small dose of the drug is given to reach

*Read at a meeting of the Philadelphia Obstetrical Society, Nov. 1, 1945.

the desired level just above the operative field. Usually this will suffice for the operation. Additional doses may be given if the operation requires longer. Thus, a very minimum of the drug can be used and at all times well controlled. If the level reaches too high or the blood pressure falls below a safe level, most of the drug can be withdrawn by aspiration.

3. The ease of administration is important. As the technique consists essentially in making and maintaining a spinal puncture, even the occasional operator can perform it easily. A spinal puncture is one of the easiest procedures in medicine, and with the addition of a few technical details the analgesia is easily given.

4. The speed of the procedure likewise offers certain advantages. Frequently a rapid cesarean section is imperative and, with the short time required for a spinal puncture plus administration of the drug, and its rapid action in producing analgesia, loss of blood to the mother and fetal mortality can be markedly lessened.

5. The decrease in postoperative complications following its use also makes it ideal. The reduction in post-operative nausea and vomiting with less abdominal distension than with inhalation agents is marked. Usually patients having continuous spinal analgesia for cesarean section can be fed the same day of operation, which eliminates many of the abdominal complaints. Urinary retention is no greater and phlebitis is probably less frequent, as also are pulmonary complications.

6. Excellent contraction of the uterine musculature, with minimal blood loss is outstanding. Few oxytoxics are required following delivery of the baby.

7. The absence of narcosis to the baby offers one of the greatest advantages of this method. There is no need for resuscitation of the baby, as respiration is initiated usually before the baby is completely extracted from the uterus, and cries immediately. This is particularly valuable in premature infants born by cesarean section.

8. Excellent relaxation of the abdominal wall is an outstanding characteristic and enables the operator to perform his task with facility and dispatch. This is essential in Waters or extraperitoneal sections where relaxation is imperative.

9. Likewise, the anesthetic causes no disturbance of previously existing pathology in the respiratory, circulatory, or genitourinary system of the mother, as the drug is low in toxicity and the minimal dose is employed.

B. *Technique.*—The technique of administering the continuous spinal analgesia is as follows: The patient is given 1½ grains (0.1 Gm.) of a barbiturate one hour before operation, having been given sedation the previous night. When she is brought to the operating room she is placed upon a special mattress which prevents bending of the needle, and placed on her side. Under aseptic precautions the initial skin wheal of procaine is made between the first and second, or second and third lumbar interspaces, together with some form of vasopressor drug. Then the stainless steel safety needle is inserted into the subarachnoid space. With the needle in one of these interspaces, the drug will reach above the umbilicus and produce the desired level for the best results. Eight cubic centimeters of cerebrospinal fluid is withdrawn and mixed with the anesthetic drug, usually procaine hydrochloride, to make a 2½ per cent solution (25 mg. per c.c.), the syringe is then connected to the tube which is filled with the solution to expel the air. The tube is then connected to the needle and the initial dose is given. Each patient is treated as a special case, but the average dose is 25 to 40 mg. of procaine. She is then turned on her back, and placed in the 5° Trendelenburg position. The needle is then checked to determine whether it is still in the subarachnoid space. This is done by aspiration of the syringe. If no fluid is aspirated the needle must be adjusted until there is a

free return flow. The length of time for analgesia to begin is usually five to ten minutes, during which time the abdominal field is prepared and draped.

The level of the drug is then determined by needle or forceps and, if satisfactory, the operation is begun. More drug, usually ½ c.c. (12½ mg.), can be added if the level is not sufficiently high, but this is seldom necessary.

The blood pressure, pulse, and respiration are carefully taken every five minutes during the operation. The systolic pressure seldom drops more than 10 to 20 mm. of mercury, and many patients have less than 10 mm. fall. If the systolic level reaches 90 mm. or less, ¾ grain of ephedrine HCl can be given hypodermically, or glucose-saline solution intravenously. Plasma should be available. In cases which show a profound fall in blood pressure a vasopressor drug can be given intravenously.

If the analgesic begins to wear off or the patient complains of any discomfort, additional doses of procaine can be given, usually in doses of ½ to 1 c.c. (12½ mg. to 25 mg.).

After the baby is extracted ¼ grain of morphine should be given hypodermically, which will reach its maximum effect after the anesthetic has been removed. Following delivery of the placenta, an oxytoxic preparation (usually ergot) is given intramuscularly as a routine procedure. Following the completion of the operation the remaining drug is partially removed, by aspiration of 1 to 2 c.c. of fluid, and the needle withdrawn.

After removal from the operating room the patient is returned to her room, and placed flat in bed. Fluids and soft food can be given the same day.

C. *Indications and Contraindications.*—Continuous spinal analgesia may be used in all types of cesarean section. The condition of the patient, however, must be good. In the presence of severe hemorrhage from placenta previa or abruptio placenta where the general condition of the patient is poor it would be unwise to use continuous spinal analgesia. In cases of prolonged labor where cesarean section becomes necessary, supportive measures must be instituted before analgesia is given.

D. *Drugs.*—Either procaine hydrochloride or metycaine (1.5 per cent in Ringer's Solution) may be used as the anesthetic agent. Both possess low toxicologic drug reaction and give no depression of vital centers. They are easily obtainable and require small amounts. Their duration of analgesia is approximately the same, and neither cause any postoperative complications.

E. *Analysis of Three Hundred Cases of Cesarean Section Under Continuous Spinal Analgesia.*—In December, 1941,[3] we gave our first continuous spinal analgesia for cesarean section at the Philadelphia Lying-In Hospital. Since that time we have used it in three hundred cases there and at the Philadelphia General Hospital and Delaware County Hospital. At first our cases were carefully selected. But as time passed and its safety was well demonstrated, its administration has become almost routine for cesarean section, except as contraindicated above.

There were no maternal deaths. There were sixteen fetal deaths but none which could be attributed to the anesthesia. Their causes are listed as follows:

I.	Stillborn	5
	Abruptio placenta	4
	Malpresentation	1
II.	Neonatal	11
	Prematurity	4
	Cerebral hemorrhage	1
	Congenital heart disease	2
	Rh—Erythroblastosis	1

The five stillborn babies were delivered of patients in whom cesarean section was performed for abruptio placenta in four cases, and in one where intrauterine fetal death had occurred from malpresentation. No fetal heart sounds were elicited before operation, and in each case the baby's death was known. All the remaining babies born in this series, including prematures from 2 pounds, 14 ounces, cried at once, were quite vigorous, had good color, and showed no narcosis.[4] Thirty-six patients were or had been in labor for periods varying from six to sixty hours. In 264 patients cesarean sections were performed in which there had been no labor.

The ages of the mothers varied from 14 to 44 years, and the length of operation from fifteen to seventy minutes. The total dosage of procaine or metycaine varied from 15 to 200 mg. In the beginning of the study 75 mg. was used as the initial dosage of the drug, but in the past six months this has been lowered to 25 to 30 mg., with satisfactory results. In many recent cases little, if any, more than the initial injection of 25 mg. has been required. Indeed, in one case in June, 1945, 15 mg. of metycaine (1.5 per cent) was given as the initial dose and no more was required until the skin was being closed at the end of the operation. An additional 15 mg. maintained the analgesia until the patient was returned to her room.

The average systolic blood pressure in the three hundred patients before the administration of the analgesia was 127.5 mm. of mercury, and at the end of the operation was 120.5 mm. of mercury. Blood pressure readings were taken every five minutes. An initial dose of vasopressor drug, usually 3/8 grain of ephedrine hydrochloride, was given routinely, except in cases of hypertension where the systolic pressure exceeded 140 mm. of mercury. In twenty-nine patients the blood pressure fell to a systolic of 80 mm. of mercury, but returned to 100 or higher with the administration of ephedrine hypodermically or intravenously, or as soon as the baby was delivered. Frequently the elevation of the feet alone, that is, autotransfusion, would return the blood pressure to its normal level within two or three minutes, or the inhalation of 100 per cent oxygen would likewise aid in blood pressure elevation.

Nausea, retching, or vomiting were infrequent, and it was estimated that no more than 15 patients (5 per cent) showed this annoying complication. In each of these instances the inhalation of 100 per cent oxygen brought relief within one or two minutes.

Only five patients received venoclysis or plasma while on the operating table, three of these being patients who had long trials of labor and required fluids, one as a precautionary measure in the delivery of quadruplets, and one, who evidently showed a toxicity of the drug as her blood pressure fell from 122/82 before giving the spinal to 70/40 within two minutes after the initial injection of 75 mg. of procaine. After the infusion the pressure returned to normal.

There were nine failures in which the operation could not be performed under continuous spinal analgesia completely. Five of these were due to technical failure to introduce the needle into the subarachnoid space, and in four cases it was necessary to use a supplementary anesthetic, as the level was not sufficiently high to proceed with the operation. Sixteen doctors were included in the group who gave the spinal analgesia, some of whom had had previous experience with the single spinal injection anesthesia, and others, particularly the resident staff, who were giving spinal analgesia for the first time under our supervision.

Postoperative complications were no greater than with the inhalation anesthetics. Headache occurred in 5 per cent of the cases, urinary retention in 8 per cent. There were no motor or sensory disturbances. One pulmonary complication occurred; this was an atelectasis which required intermittent inhalation of oxygen plus postural treatment. Nausea and vomiting were consider-

ably reduced over the inhalation anesthetics, as was postoperative distention. In a large majority of our patients fluids and food were given the same day of operation with good results. Indeed, it was the rule that the patients complained of hunger if not fed on the first day. Only two patients required exceptional treatment for distention, these being cases of prolonged labor before operation where Wangensteen drainage was necessary for relief.

In listing our indications for cesarean section, we have formed our own classification which follows closely that of other clinics. The apparent discrepancy in the number of indications in comparison to the total cases is due to the fact that some patients had more than one indication for the operation. For instance, several of our toxemias also revealed a cephalopelvic disproportion, or our previous sections were traced to disproportions which occurred in former deliveries.

TABLE I. INDICATIONS FOR CESAREAN SECTION

1. Cephalopelvic disproportion		102
2. Pelvic tumors		16
3. Premature separation of placenta		10
4. Placenta previa		18
5. Toxemia of pregnancy (including eclampsia)		20
6. Cardiac disease		6
7. Pulmonary disease		3
8. Kidney disease		2
9. Elderly primiparae		3
10. Recent or extensive vaginal plastic surgery		18
11. Elective cesarean section	a. Previous section	66
	b. Valuable baby	2
	c. Difficult previous delivery with questionable measurements	6
	d. Uterine anomalies	4
	e. Diabetes	3
	f. Prolapse of cord	3
	g. Malpresentation	22
	h. Rh syndrome	3
12. Dystocia syndrome		12
13. Prolapsed colostomy with obstruction		1

TABLE II

Endometritis	23
Pyelocystitis	12
Mastitis	9
Thrombophlebitis	2
Intercurrent infection	3
Dehydration	1
Morbidity—cause unknown	2
Wound infection	2
Atelectasis	1

Postoperative morbidity occurred in fifty-five patients (18.3 per cent). The standard classification of morbidity being used, i.e., an elevation of 102.2° F. or over on two successive occasions excluding the day of operation.

The type of cesarean section varied according to the indication and to the existence of any previous labor. In the patients with no previous labor the classical or Kerr type were performed. If labor had been present the Kerr or Waters section were procedures of choice.

TABLE III. TYPES OF CESAREAN SECTION

Classical	180
Kerr	104
Waters	12
Porro	4

Summary

From the experience of delivering three hundred patients by cesarean section under continuous spinal analgesia with no maternal deaths, we feel that it is a safe anesthetic for both mother and child. All of the babies (excepting the stillborn) showed no anoxemia, cried at once, were a good color, and required no resuscitation.

The postoperative morbidity of the mother was low, and the complications were no greater than with inhalation anesthetics.

The advantages of continuous spinal analgesia with its safety, low dosage, and controllability are emphasized and should make its use desirable in cesarean section.

The technique is easy and requires only the care and caution that should be given when administering any anesthetic.

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Discussion

DR. CLIFFORD B. LULL.—I can remember the time when I was one of the most vehement objectors to the use of spinal anesthesia in cesarean section. I have always admired Doctor Cosgrove of Jersey City who persisted in its use during all these years. The history of anesthesia for cesarean section at the Lying-In Hospital shows that for the last twenty-five years an endeavor has been made to get away from general anesthesia in these cases. We used the one-dose spinal, but after seeing the report of several deaths many years ago, we discontinued its use. During the years that followed, we did as many of our cesarean sections as possible under local anesthesia. The rest of our cases were done mainly under nitrous oxide and oxygen. Following the development of fractional spinal by Dr. Lemmon, we went back to the use of spinal anesthesia in our cesarean section cases and have had excellent results. I believe this can be attributed to three factors: The control by the fractional method, the use of much smaller doses, and the availability of drugs of much less toxicity. After using continuous caudal analgesia for our vaginal deliveries, we began doing our cesareans under this type of pain relief. In addition to the series that Doctor Ullery reports here, we have performed more than 200 cesarean sections under continuous caudal anesthesia, and we have endeavored to evaluate, during the past three years, whether there is any difference in caudal, fractional spinal, and local anesthesias. We are of the opinion that fractional spinal is unquestionably the anesthetic of choice, although the difference between caudal and spinal is very slight, particularly as far as the convalescence of the patient is concerned. It takes longer for the proper level to be obtained under caudal, which increases the length of time spent in the operating theater. The benefits of these types of anesthesia have been very aptly discussed in the summary of Doctor Ullery's paper and I would particularly impress upon you the fact that we have had no trouble with the babies. The only ones who needed attention particularly were the ones who took a breath before they were extracted from the uterus. The second important fact is the uterine contraction, which occurs immediately, and the distinct decrease in blood loss. The convalescence of these patients is extremely smooth as they are able to partake of food within a short time after the operation is performed, and many patients who have had previous sections under general anesthesia will say that they felt much better on the first postoperative day than they did on the fourth or fifth day after their first cesarean operation. From our experience we believe that the use of general anesthesia in cesarean section will be limited to certain selected cases, or where trained anesthetists are not available to give the other types of anesthesia.

THE Rh FACTOR IN OBSTETRICS*

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THE Rh factor in obstetrics has held the attention of the obstetrician and the laity for the past few years. Because of articles in lay women's magazines, many pregnant women have become Rh conscious, and have bombarded their obstetricians with numerous and varied questions regarding this rather important subject. As a matter of fact, many laboratory technicians and nurses have had this test performed on their own blood and, if negative, have by subterfuge or other means obtained a sample of blood from their prospective husband in order to determine his Rh factor. With the rare occurrence of erythroblastosis, this possible blood incompatability is not too serious and, as suggested by Diamond,[1] there are many far more serious incompatabilities in many husbands and wives than this Rh incompatability.

It is now generally accepted that Rh typing, in addition to the usual blood grouping and cross-matching, is essential in order to insure maximum safety in blood transfusions. This is especially true in cases where multiple transfusions have to be administered. According to Diamond,[1] 80 to 90 per cent of all hemolytic blood transfusions can be explained by Rh incompatability.

In obstetrics, the infant mortality due to erythroblastosis or hemolytic anemia of the newborn can be decreased by utilizing the information acquired from the routine Rh typing of all obstetric cases. This information forewarns us of the possibilities and probabilities of hemolytic anemia in the newborn, so that appropriate safeguards may be taken, and we may be prepared to interfere at the proper time with early induction of labor, or with immediate blood transfusions.

It is generally agreed[5] that erythroblastosis in the first born of Rh-negative women usually does not occur, i.e., one or more pregnancies with an Rh-positive fetus are necessary to produce isoimmunization of a sufficient intensity to produce hemolytic anemia in the next Rh-positive infant. The exceptions to this are in cases of Rh-negative women who have been previously immunized by transfusions of Rh-positive blood. The first born of these latter women may have erythroblastosis.

My personal management in the following series of 300 cases was as follows:

1. Every pregnant woman has a specimen of blood taken for the Rh factor and blood group determination at her first or second prenatal visit. The blood for the required Hinton test is obtained at the same time.

2. If the patient is Rh positive, nothing further is done in so far as her blood factor is concerned, since we know that complications may arise only in the Rh-negative women who have Rh-positive fetuses. There is one exception

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to this, as has been shown by Wiener[8] and Diamond,[1] in cases where we have subtypes of Rh (Rh_1 or Rh_2); here the mother, although Rh positive, may develop agglutinins against the Rh fraction which is foreign to her, and later under a similar set of conditions may develop transfusion reactions or may give birth to erythroblastotic infants. These cases are extremely rare.

3. If the mother is Rh negative, then an Rh determination is made from the husband's blood, and if he is Rh negative, there can be no incompatability, and no further tests are performed.

4. If, on the other hand, the mother is Rh negative and the father Rh positive, we have the factors for possible hemolytic anemia or erythroblastosis. In these cases we test the mother's blood for anti-Rh agglutinins at the seventh month. If no appreciable agglutinins are found at this time we may assume that there will be no trouble, and may allow this patient to go to term. After delivery, the baby's blood is examined for anemia and the Rh factor. If the baby is Rh negative, then we know that the father is a heterozygous Rh positive, and his offspring may be Rh positive or Rh negative. If the baby is Rh positive then we know that the father may be either homozygous or heterozygous Rh positive. A further test on the father's blood will determine into which group he belongs.

5. When anti-Rh agglutinins are found in the mother's blood at the seventh month, we check her titer every two weeks and, if there is no increase in the anti-Rh agglutinins, we allow the patient to complete eight full months of pregnancy and, if we feel that the baby is large enough to have a good chance for survival, we induce labor at this time. If there is a marked increase in the titer we weigh the various possibilities and may induce labor one week before eight full months of pregnancy. We do not feel that it is advisable to induce labor earlier than that, because the baby is usually too premature to survive.

6. After these babies are delivered, we examine the baby thoroughly for evidence of erythroblastosis, and do an Rh factor and complete blood examination. If the infant shows evidence of hemolytic anemia, the child is transfused with Rh-negative compatible blood. A complete blood examination is performed daily and, if hemolysis is still going on, more transfusions are administered until the baby's blood is normal, or the hemolysis has stopped. If this is done, many of the erythroblastotic babies will be saved.

7. We do not allow breast nursing in erythroblastotic infants because anti-Rh agglutinins may be secreted in the milk and, after absorption through the stomach, may produce further hemolysis of the infant's Rh positive cells.[1, 8, 9]

In a series of 300 consecutive personal deliveries, there were 32 Rh-negative mothers. The remaining 268 were Rh positive; therefore, approximately one out of every nine mothers was Rh negative. This is what one would expect in the general white population.

Examination of the husband's blood of these 32 Rh-negative mothers revealed the following: 22 Rh positive, and six Rh negative. The blood of the remaining four husbands was not obtained because they were serving in the Armed Forces and were overseas.

In the matings of the 22 Rh-positive husbands with the Rh-negative mothers, the infants were Rh positive in 15 cases and Rh negative in seven. In this series, at least seven out of the 22 Rh positive fathers were heterozygous.

Of the 15 cases in which the factors for potential erythroblastosis were present, that is, an Rh-negative mother, with an Rh-positive father and an Rh-positive fetus, there was only one case of true erythroblastosis, and two cases in

which the babies developed a slight amount of jaundice, although the blood picture was normal. Only two of these three mothers whose babies were jaundiced showed an appreciable amount of anti-Rh agglutinins in their blood after the seventh month. Labor was induced before term in both cases, and only one of these mothers gave birth to a true erythroblastotic fetus. That fetus was given five transfusions of Rh-negative blood and is now alive and well.

In this same group of 15 cases, seven were primiparas, seven were secundipara, and one was a tertipara. Assuming that with rare exceptions, as noted above, primigravidas do not develop erythroblastotic babies, we found only eight women who had the factors for potential erythroblastosis in the infant, and only one gave birth to a true erythroblastotic baby.

CASE 1.—Mrs. A. G., aged 31 years, gravida ii, para ii, Group O, Rh negative; husband Group O, Rh positive. First baby 4 years old, normal. Second pregnancy: normal prenatal course except for slight trace of albumin at last two prenatal visits. Blood pressure: systolic 120, diastolic 70. At eight months anti-Rh agglutinins were found in the mother's blood. Labor was induced three weeks from term. A male child weighing 7 pounds, 4 ounces was delivered normally. Shortly after birth he showed minimal evidence of erythroblastosis in that he appeared slightly edematous and had an enlarged liver. A few hours later jaundice was present and edema was more pronounced. A transfusion with 75 c.c. of Group O, Rh-negative blood was given immediately. The next day the red blood count was 5.1 and hemoglobin 94 per cent, with many nucleated red blood cells on smear. On the second day the red blood count dropped to 3.85, with 86 per cent hemoglobin; and another transfusion of 75 c.c. was administered. On the third day a third transfusion of 50 c.c. was given. On the fourth day blood examination showed his red blood count to be 6.1, with 122 per cent hemoglobin. On the fifth day there was a slight drop to 4.6 red blood count and 109 per cent hemoglobin. The blood picture stayed at about that level until the third week, when the blood began to drop and reached a low level of 2.4 red blood count, 44 per cent hemoglobin, with 2.7 per cent reticulocytes. During this third week the jaundice increased. At this time the fourth transfusion was given with marked improvement, and two days later a fifth transfusion was given, which was followed by a striking improvement in the infant's general condition. He was discharged home improved at the age of one month. He is now 10 months old and is progressing normally.

CASE 2.—Mrs. F. G., aged 30 years, gravida iii, para ii, Rh negative, Group A, husband Rh positive, Group A. Her first pregnancy terminated in a miscarriage at two months (January, 1942). Her second pregnancy went to term and she was delivered of a normal male child (May, 1943). In her third pregnancy she showed anti-Rh agglutinins in her blood at the eighth month. Labor was induced two weeks from term, and she was delivered normally of a male child on April 2, 1945. The baby was Rh positive and developed a slight amount of jaundice on the first postpartum day. Examination of the blood was normal. The jaundice subsided in a few days, and the baby's blood continued to remain within normal limits. Since there was no evidence of hemolytic anemia, no transfusions were administered. The birth weight was 6 pounds, 2 ounces. The baby was discharged well on the tenth day, weighing 5 pounds, 14 ounces with a normal blood picture.

Summary

1. The Rh factor in obstetrics is discussed.

2. Every obstetric patient should have an Rh determination during her prenatal course.

3. When anti-Rh agglutinins are present, labor should be induced before term.

4. Erythroblastotic babies with hemolytic anemia should be treated with immediate transfusions.

5. Transfusions reduce the mortality in erythroblastosis fetalis.

6. Three hundred consecutive deliveries are analyzed. In this group two women had anti-Rh agglutinins present and had labor induced before term. One of these infants had true erythroblastosis fetalis and, with five blood transfusions, survived and is alive and well.

7. The incidence of erythroblastosis fetalis in this series was 1 in 300.

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THE KIELLAND FORCEPS FOR USE IN THE OCCIPITOPOSTERIOR AND OCCIPITOTRANSVERSE POSITIONS*

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IN A recent paper on occipitoposterior position, Hennessy[1] stated: "The occipitoposterior position is perhaps the most common and important abnormality in the mechanism of vertex presentations. Its management has long been a matter of discussion. Although the literature on the subject is voluminous, there will undoubtedly be many more contributions, for there will always be a posterior."

The occipitoposterior position is probably much more common than is generally supposed. The reported incidence varies greatly: Tweedy and Wrench[2] reported 121 cases in 15,167 deliveries (0.8 per cent); Williams,[3] 11.3 per cent in 5,000 cases; Scott,[4] 14.04 per cent in 1,000 consecutive cases; Piper,[5] 17.1 per cent; and Danforth,[6] 25.1 per cent in 1,131 private deliveries. D'Esopo[7] noted that 19 per cent of all vertex presentations engaged in the posterior position.

In 1915, Christian Kielland of Norway presented a new type of forceps before the Munic Gynecological Society. Greenhill,[9] in 1924, summarized 36 statistical reports concerning the use of the Kielland forceps in 1,762 deliveries. Most of the authors agreed that the instrument was a definite advance for delivering babies when the occiput is not in the anterior half of the pelvis. Jarcho[8] has by diagram demonstrated satisfactorily the use of the instrument.

Briefly, this instrument is very light, with a very slight pelvic curve, a sliding lock, and a small knob attached to each handle. Before the instrument is applied, it is placed in front of the patient with the concave margins of the blades toward the occiput. The anterior blade is introduced first. The blade is introduced between the cervix and the head, with the cephalic surface of the blade facing upward. It is pushed up gently until the entire blade is completely above the symphysis pubis and the shank lies in the subpubic angle. At this time the blade is rotated on its own axis in the direction of the knob. This rotation caused the cephalic surface of the blade to lie on the baby's head. The posterior blade is then introduced in the same fashion as one would for an occiput anterior. Occasionally, the posterior blade will not enter easily because it encounters the anterior surface of the sacrum. This can be corrected by depressing the handle of the blade, causing its tip to hug the occiput and, under guidance of the hand in the vagina, application is completed. After the blades are locked, traction is applied in the direction in which the handles point until the head enters the largest diameter of the pelvis. At this point the forceps are rotated gently on the long axis without traction until the small fontanel reaches the subpubic region. When the mucha impinges under the symphysis

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pubis, the forceps are removed and delivery completed in the usual way. The application of the forceps for the occipitotransverse position is essentially the same.

Record of Cases

We wish to report 200 consecutive occipitoposterior or occipitotransverse positions delivered by mid-Kielland forceps at The Bronx Hospital. These patients were delivered by different physicians on the private and ward services. Many of the cases were delivered by the house obstetricians under the supervision of one of the visiting staff physicians. In all of the cases, the pelvis was clinically ample and the vertex was engaged at the time of delivery. We do not advocate the use of high forceps at any time, preferring (1) a version when version is not contraindicated, or (2) a cesarean section where there is cephalopelvic disproportion.

In the beginning, it was felt that lacerations of the pelvic floor were more extensive when the Kielland forceps was used for extraction as well as rotation. Therefore, on 23 occasions the Kielland forceps was used for rotation, and the Elliott or Dewees forceps for the extraction. Experience has disproved this assumption.

TABLE I

PARITY					POSITION OF VERTEX AT TIME OF DELIVERY				INDICATIONS FOR TERMINATION OF LABOR			TYPE OF LACERATION					
PRIMIGRAVIDA	GRAVIDA II; PARA I	GRAVIDA III; PARA II	GRAVIDA IV; PARA III	GRAVIDA VI; PARA V	LEFT OCCIPITOPOSTERIOR	RIGHT OCCIPITOPOSTERIOR	LEFT OCCIPITOTRANSVERSE	RIGHT OCCIPITOTRANSVERSE	PERSISTENT OCCIPITOPOSTERIOR OR OCCIPITOTRANSVERSE WITHOUT PROGRESS	PERSISTENT OCCIPITOPOSTERIOR OR OCCIPITO-TRANSVERSE WITH FETAL DISTRESS	PERSISTENT OCCIPITOPOSTERIOR CARDIAC; FULLY DILATED	LACERATION OF CERVIX REQUIRING REPAIR	DÜHRSSEN'S INCISIONS	FIRST DEGREE OF PERINEUM	SECOND DEGREE OF PERINEUM	THIRD DEGREE OF PERINEUM	EPISIOTOMY
160*	23	14	1	2	49	98	37	16	117	77†	6	10‡	6†	22	27	5	110

*This included four cases of gravida iv; para 0, and 9 cases of gravida ii; para 0. (All essential primigravidas.)

†In 6 of these cases there was not quite full dilatation. Dührssen's incisions were used before the application of the Kielland forceps. An episiotomy was also performed.

‡All 10 cases also had an episiotomy. The six cases of Dührssen's incisions are included in this total.

Indications for Termination of Labor

In this series of cases (Table I), 80 per cent (160 patients) were primigravidas. Among the multiparas, there were ten who had had a Kielland forceps delivery with their first baby. The most common position was right occipitoposterior, occurring 98 times; i.e., 44 per cent of the cases.

The indications for the termination of labor were strict. Full dilatation for two hours or more without progress was the indication in 112 cases (56 per cent). In 77 cases (33⅓ per cent), the indication was fetal distress with full dilatation, except as noted below. Of course, in these cases the two hours of second stage labor was waived. Fetal distress was denoted not alone by the passage of meconium, but by the combination of a rising or falling fetal heart rate in addition to the passage of meconium. Among these 77 patients, there were six primigravidas who developed fetal distress when not quite fully dilated. In each case it was felt that the cervix was dilatable. Dührssen's incisions were performed before the application of the forceps. Living babies resulted in all cases. The mothers' puerperia were uneventful.

There were six cases of compensated mitral stenosis, where the second stage was entirely eliminated. Forceps were applied when full dilatation was attained.

Type of Laceration

There was no laceration in 20 patients (10 per cent) of the cases in this series.

The third degree lacerations, five in number, occurred in primigravidas. Healing took place by primary intention following immediate repair of the pelvic floor and anal sphincter. It was felt that in each case the laceration was sustained because the concurrent episiotomy was not of sufficient length.

In 10 cases there was a cervical laceration requiring repair. Of these, in six cases Dührssen's incisions were the cause of the laceration. In the other four cases inspection of the cervix following the delivery revealed unilateral lacerations because of bleeding not due to a relaxed uterus. These were immediately sutured. There was no subsequent morbidity in the mother.

Maternal Mortality and Morbidity

A patient having a temperature of 100.4° F. on two occasions, excluding the first postpartum day, was considered a morbidity. There were 42 cases, or 21 per cent, with morbidity. Their causes are noted in Table II.

TABLE II. MORBIDITY

CAUSE	NUMBER OF CASES
Pyelitis	3
Infected episiotomy	2
Uterine infection	24
Nonsuppurative mastitis	1
Parotitis	1
Aspiration pneumonia	1
Undetermined	10

There was one maternal death:

CASE 1.—(Hosp. No. 22081.) A 29-year-old primigravida who had ample pelvic measurements. After a seventy-two-hour labor with a two-hour second stage, the head was arrested in left occipitoposterior position. The Kielland forceps was applied and the head was delivered with moderate difficulty. The baby weighed 7 pounds, 14 ounces, and was in good condition. Bleeding occasioned by a left cervical laceration was controlled by a repair. A laceration through the posterior vaginal wall, extending into the rectum, was repaired. The sphincter was not injured. The patient was given a 750 c.c. clysis of saline solution. She was returned to her room in good condition and reacted well until the third day post partum. At this time she complained of a painful swelling of the left vulval region. On examination a huge hematoma was noted. She was immediately removed to the operating room for transfusion and operation. Before these procedures were begun she suddenly expired. No doubt

this internal hemorrhage had been growing for some time, but was not noticed until it had reached a lethal limit. Closer observation of this patient in her puerperium might have resulted in earlier recognition of the condition, with a strong possibility of avoiding this calamity.

Fetal Mortality

In this series of cases there were 11 stillbirths and three neonatal deaths, a percentage of 7 per cent. Six of the stillbirths occurred in patients with prolonged labors where the fetal heart was lost before the forceps application, making a corrected fetal mortality of 4 per cent. In three other cases difficulty was experienced with the delivery of the shoulders resulting in stillbirths. In the remaining two cases no obstetric reason for the stillbirth could be determined. All of the 11 cases showed cerebral hemorrhage at necropsy.

The three neonatal deaths also showed cerebral hemorrhage at autopsy.

Discussion

The Kielland forceps is not a panacea for all occipitoposterior or occipitotransverse deliveries. In the hands of those well versed in the mechanics of the instrument, it comes nearer to being the universal method of choice than any other procedure. Manual rotation of the head followed by forceps application for extraction very frequently is a failure because of the difficulty in keeping the head in the anterior position while applying the blades. In addition, not infrequently the head is dislodged during this procedure. In the Pomeroy maneuver it is necessary to disengage the head in order to be able to rotate the shoulders. This method again entails the disadvantage of entering the uterus, with the possibilities of infection, in addition to the ever-present danger of prolapsing the cord. The Scanzoni maneuver, no doubt an excellent procedure in good hands, has the disadvantage of the necessity of multiple applications. Frequently, rotation is difficult because of the large pelvic curve of the ordinary forceps (Simpson, Elliot, Tucker-McLane). This necessitates rotation through a comparatively large arc, and no matter how careful the operator is in describing the small arc with the tips of the blades by rotating the handles through a large arc, the attendant injuries of the soft parts as a result of this procedure is an ever-present danger.

With the Kielland forceps the disadvantages of the other maneuvers are overcome. Once applied, rotation through a small arc is possible without reapplication, and with a minimum potentiality for injuries to the soft parts. In other words, rotation and extraction are accomplished with only one application. The hazards that are attributed to the introduction of the anterior blade of the Kielland forceps really do not exist when the instrument is properly applied. We have never seen a rupture of the bladder in our cases. The cases of vesicovaginal fistulae resulting from the use of the Kielland forceps reported in the literature can be attributed to two possible causes. The first, devitalization of the vesicovaginal septum resulting from the incessant pounding which it suffers from the head in a prolonged labor. Such a condition is occasionally encountered in normal spontaneous deliveries. The second, and more important, explanation for bladder injuries with the use of the Kielland forceps must be looked for in the shortcomings of the operator rather than in those of the in-

strument. Bladders have been torn with the ordinary obstetric forceps when improperly used by inexperienced operators. Everything else being equal, the instrument is as good as the obstetrician who wields it.

In the series of cases here presented, we feel sure that the more serious injuries obtained could have been avoided to a great extent, or at least minimized, had the particular operators been better acquainted with the instrument, and more liberal with episiotomy.

Summary

1. Two hundred cases of persistent occipitoposterior or occipitotransverse positions delivered with the Kielland forceps are analyzed.

2. There was one maternal death.

3. There were 14 fetal and neonatal deaths. In six cases the fetal heart was lost before the forceps were applied. The corrected fetal mortality was 4 per cent.

4. The advantages of the Kielland forceps are discussed.

Conclusions

1. The dangers attributed to the Kielland forceps by other reports have no basis of fact.

2. The Kielland forceps comes nearer to being the universal method of choice for the treatment of persistent occipitoposterior or occipitotransverse position.

3. Under proper supervision the use of this instrument can be easily learned by any one who has had a proper obstetrical training.

We wish to express our appreciation to Dr. Meyer Rosensohn for his interest and stimulating advise in the preparation of this report. We are grateful to Comdr. Abraham J. Fleischer, U.S.N.R., and Dr. Jacob Clahr for aid in the preliminary studies.

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THE ORIGIN OF ADRENAL-LIKE TUMOR OF THE OVARY*

(Hypernephroma of Ovary, Adrenal Tumor of Ovary, Masculinovoblastoma, Luteoma, Luteinoma)

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ASIDE from arrhenoblastoma, masculinization may also be produced by an adrenal-like tumor of the ovary. Only 15 well-authenticated cases of this rare growth have been reported in the literature, not including the one herewith presented. Despite its rarity, all should be conversant with the characteristics of this unusual kind of masculinizing tumor, for knowledge of it has a direct bearing on our understanding of other ovarian neoplasms.

The adrenal-like tumors thus far described have been remarkably similar. All but one have been unilateral. Although ranging from microscopic to orange size, nearly all have been small nodules not larger than a walnut. Most of the growth is usually buried in the ovary, sometimes protruding from the surface, but always covered by at least a thin layer of ovarian tissue. The color has been invariably yellow except in one case; a distinct orange-yellow is the predominant color. All of these tumors are solid, rubbery, and ovoid. Usually the growth is lobulated by fibrous septa which radiate from the capsule.

Microscopically, the tumor is composed of large, polyhedral, eosinophilic cells disposed in cords, nests, and anastomosing strands. They fill in the spaces of a network formed by capillaries branching out from scattered larger vessels. Stroma is usually scanty. The cells have distinct outlines and a granular protoplasm; the nuclei are chromatic rather than vesicular; nucleoli are invariably present. Considerable lipoid material is usually to be seen.

All authentic adrenal-like tumors of the ovary present symptoms of masculinization. Amenorrhea, hirsutism, and hypertrophy of the clitoris always occur and are indistinguishable from similar disturbances characteristic of arrhenoblastoma. In addition, some of the reported cases of adrenal-like tumor had glycosuria, polycythemia, and hypertension; these are equally suggestive of adrenal cortical disturbances or tumor or basophilic adenoma of the pituitary gland, but they do not usually occur with arrhenoblastoma.

Case Report

L. C., No. 3878, a patient 23 years of age, operated upon June 15, 1943, by Warner S. Bump, complained of infertility, amenorrhea for six years, acne of the shoulders, marked growth of hair, and a lowered pitch of the voice.

Examination revealed marked universal hypertrichosis of the body surfaces. The clitoris was greatly enlarged. Pelvic palpation, x-ray examination of the skull, and air insufflation of the perirenal tissues failed to disclose other

*Read before the Chicago Gynecological Society, November 16, 1945.

abnormalities. The blood pressure was 125/80, the urine normal (no sugar). There was a polycythemia of 5,480,000, hemoglobin 13.5 Gm., the differential count normal.

Surgical exploration of the abdomen revealed an orange-yellow, small, rather firm tumor in an otherwise apparently normal right ovary. The ovary was removed. The other internal genitals were of normal appearance, except that the left ovary was of notably small size.

Fig. 1.—Adrenal-like tumor of ovary, case 3878. Actual size of one-half of ovary with one-half of tumor. The surface of the tumor appears rounded because the specimen was bisected before fixation. The growth was of distinctly yellow color and of firm consistency.

Fig. 2.—Adrenal-like tumor of ovary, case 3878. Specimen has been cut at right angle to surface shown in Fig. 1. Grossly, the growth is similar to a corpus luteum, but it is more firm, more definitely a tumor surrounded by a crescent of ovarian tissue. (×2¾.)

Menstruation began two months after operation and continued regularly and normally, four days in duration, until the patient became pregnant at the end of one year. Gestation terminated in premature birth of a female child who lived only one hour. When last seen, just prior to the labor, there had been no notable change in the hypertrichosis, and the voice was still somewhat husky. The acne had improved, and the clitoris had returned to normal.

The tumorous right ovary, bisected immediately after removal, consisted of an orange-yellow tumor, which comprised approximately two-thirds of the

ovary, surrounded by a gray crescent of firm ovarian tissue. Toward the hilus the ovarian tissue was represented mostly by the tumor capsule, there being very little ovarian tissue overlying the capsule; even here, there was no prominence on the surface of the ovary.

The entire bisected specimen, after prolonged fixation (Fig. 1), was 3 by 2.7 cm. on the surface and 0.8 cm. in thickness (representing one-half of the thickness of the entire specimen). The tumor was buried in the ovarian tissue, and protruded disc like from it, 2 by 1.8 cm. in surface measurements. The tumor surface was granularly smooth, in gross appearance resembling adrenal tissue or a tumor of the corpus luteum.

When cut at right angles to the position shown in Fig. 1, the slightly magnified gross specimen is seen to be lobulated by fibrous septa which radiate from the capsule (Fig. 2).

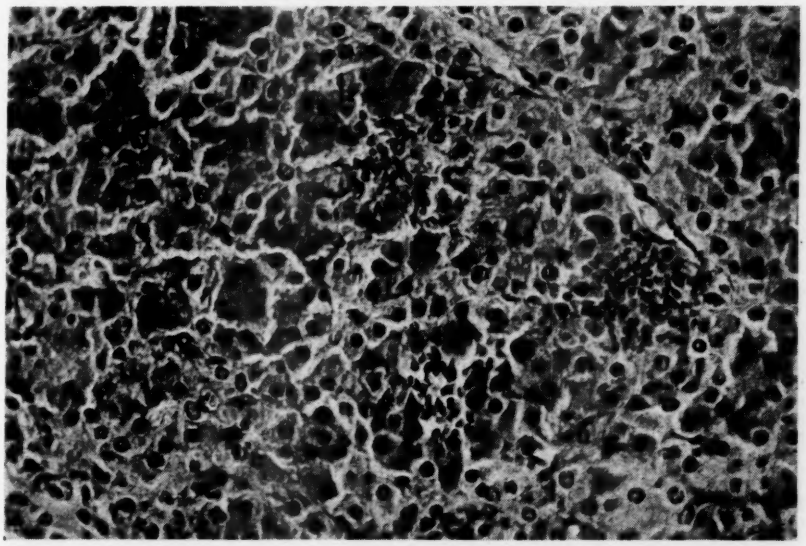


Fig. 3.—Adrenal-like tumor of ovary, case 3878. Clusters of polyhedral cells arranged in acini. Note the rich sinusoidal blood supply. (× 270.)

Microscopic examination reveals massive strands, wedge-shaped areas, and isolated clusters of cells arranged in acini, also cord-like patterns and anastomosing networks, like the zona fasciculata and the zona reticularis of the adrenal cortex. All of these are polygonal cells, provided with a rich sinusoidal blood supply. The individual cells are clearly demarcated and lie in close apposition. The nuclei are sharply outlined, chromatic, the nucleoli small, deeply staining, eccentrically placed. The cells of this group, similar in outline and in nuclear characteristics, differ greatly in staining reaction, some dark and containing much pigment, others much lighter and almost devoid of granules in the protoplasm, although the nuclei are distinctly granular (Fig. 4).

Other lightly staining cells constitute the more stroma-like, greater bulk of the tumor. Here the blood supply is scanty. The tissue still preserves a richly cellular character, composed of more spindle-shaped cells in a loosely woven pattern. The cell boundaries are less clearly defined than those of the previously described adrenal-like cells, and are provided with a fine collagenous network of intercellular fibrils (Fig. 6). The nuclei are more ovoid and darker, manifesting a tendency to deviate, together with the stroma, into a

stromatogenous pattern. In many areas of the tumor there is a clearly defined transition from the adrenal-like polygonal epithelioid type of cells to the spindle-shaped type of cells.

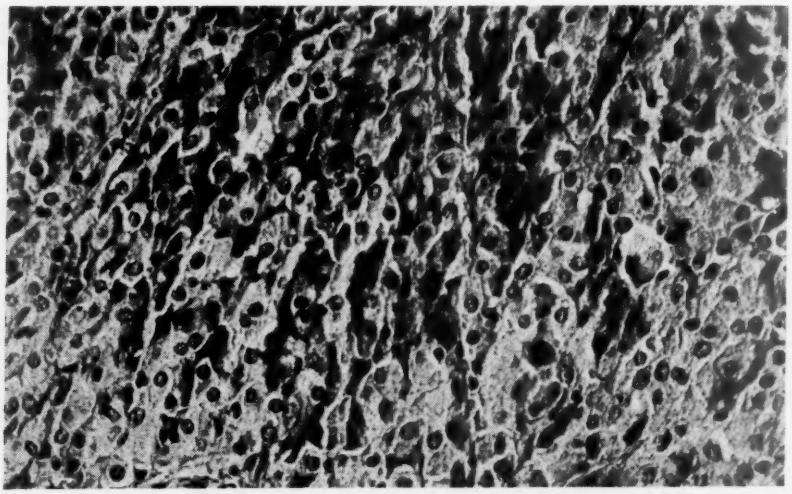


Fig. 4.—Adrenal-like tumor of ovary, case 3878. Dark cells, containing much pigment, and light cells, almost devoid of granules, are comparable with kindred cells of the adrenal cortex. (× 270.)

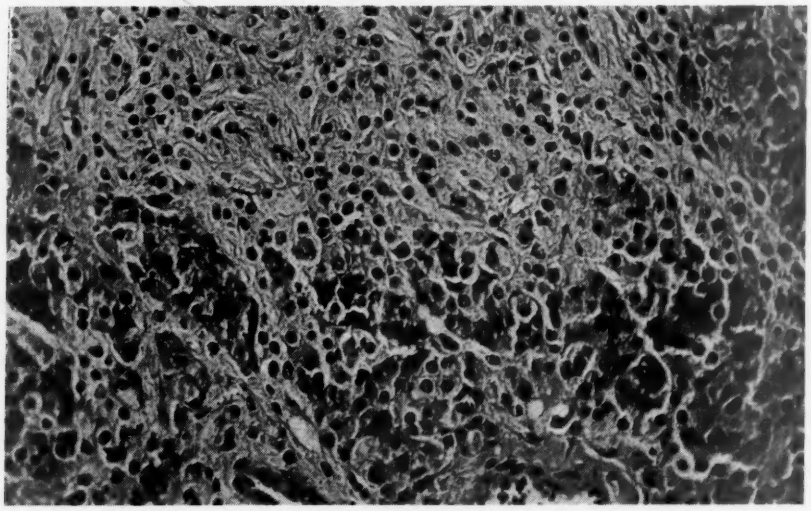
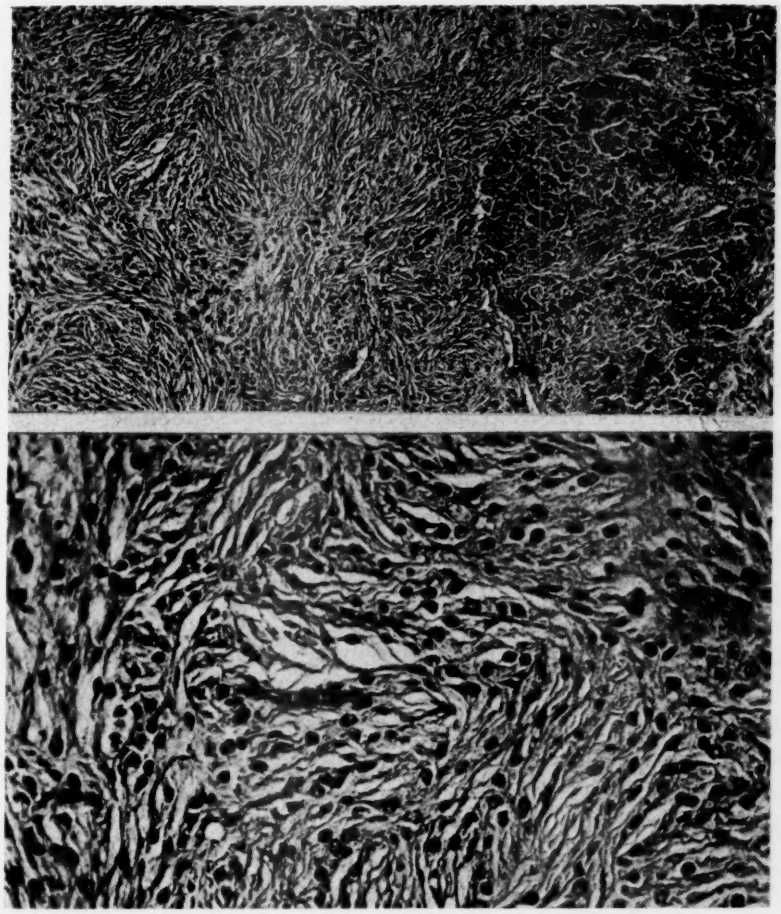


Fig. 5.—Adrenal-like tumor of ovary, case 3878. Note the gradual transition from polygonal cells to a more stromatogenous type. (× 205.)

Fat is present in considerable amount, chiefly intracellular. Some is in the form of larger particles, but much more is in fine granules. Most fat is found in necrotic areas (which are a feature of this tumor); a considerable amount is present in the light staining cells, little in the dark cells.

Although, grossly, the tumor has a rather definite capsule and appears delimited from the ovarian tissue, microscopically the transition is often not clearly demarcated, and a richly cellular, often hyalinized capsule of greatly

varied thickness gradually merges in many places into the ovarian stroma. In the ovary, some ova are seen. There are some larger follicles with marked luteinization of both granulosa and theca. The stroma is richly cellular, consisting of actively proliferating spindle cells with a tendency to formation of a basket weave and differentiation in an epithelial direction. Whatever has stimulated the tumor growth has evidently had a similar activating influence on the ovarian stroma.



A.

B.

Fig. 6.—Adrenal-like tumor of ovary, case 3878. *A.* There is gradual transition from a polygonal adrenal type of cells on the right to a stroma composed of spindle-shaped cells on the left. (× 95.) *B.* Higher magnification of the field shown above on the left, revealing finer details of the cellular pattern—a thecoma-like basket weave of stroma cells provided with a network of intercellular fibrils. (× 270.)

Discussion

The pathologic diagnosis of an adrenal-like tumor of the ovary is relatively simple if study of the growth is aided by a history of masculinization. The latter is essential; without it a positive diagnosis is unwarranted, irrespective of the gross and microscopic evidence. Postoperative recession of symptoms and gradual resumption of normal physiologic activity confirms the diagnosis.

In contrast with the ease of identification of this tumor, knowledge of its origin has remained a puzzle. It has been the consensus that a decision relative to the genesis and nature of the growth is unwarranted on the basis of evidence thus far accumulated. A teratomatous derivation is admitted as a theoretical possibility, but has been relegated to a position of secondary importance. The possibility of corpus luteum origin or of development from adrenal rests in the ovary has brought forth much speculation and many interesting discussions. Because the corpus luteum is a highly specialized evanescent glandular structure, Miller and Meyer dismiss the thought of a tumor originating from it. Schiller, in speaking against a lutein cell origin, says that a luteoma, in order to be of theca lutein or granulosa lutein origin, must be of connective tissue type, whereas the type of tumor under consideration is comprised of epithelial cells. He states further that as long as granulosa cells are not luteinized they show their mesenchymatous origin by connections with the protoplasm of syncytial cells, but that all luteomas thus far described show no such cell-connecting fibers.

Saphir and Lackner demonstrated that there are two kinds of yellow ovarian tumors which resemble each other. One is the masculinizing tumor under present consideration. The other is a nonmasculinizing hypernephroid carcinoma; it evidently arises from intraovarian mesonephric or teratomatous rests, and is similar to hypernephroid carcinoma of the kidney. This hypernephroid clear-cell adenocarcinoma of the ovary is microscopically quite different from the tumor we have been considering, does not arise from suprarenal cortical tissue, and evidently accounts for many of the growths which have long been recorded in the literature as hypernephroma of the ovary.

It is worthy of note that only the malignant cortical tumors of the suprarenal gland produce virilism. In contrast, adrenal-like tumors of the ovary are nearly all benign (potentially malignant), suggesting some other origin. Also, if adrenal rests do give rise to adrenal-like tumors of the ovary it is strange that adrenal rests are rarely, if ever, demonstrable in the ovary. Those reported are usually confused with corpora atretica (Miller).

Zwemer, Wotton, and Norkus demonstrated that in the adrenal gland new glandular cells of the adrenal cortex are derived from indifferent cells of the capsule. The process occurs by growth inward from fibroblast-like previously undifferentiated cells of the capsule which undergo morphogenesis during migration. A gradual progress inward of the adrenal cortex cells, comparable with the slow movement of a viscous fluid, has already been noted by many other observers.

In a study of adrenalectomized ground squirrels sacrificed from three days to one year after adrenalectomy, Groat demonstrated extensive growth of adrenocortical-like cells in the ovaries. The process was demonstrated to be a metaplasia of stroma cells of the ovary and mesenchyme-like cells in the mesovarium into an epithelial type of cell. In one animal, one hundred and eighteen days after adrenalectomy, the medulla of the ovary was solidly filled with this adrenal-like tissue, there were clumps in the cortex, and one large body extended from the mesovarium into the ovary.

Let us summarize the available evidence concerning the nature of an adrenal-like tumor.

The fact that adrenal rests in the ovary are exceedingly rare at once makes questionable such origin of adrenal-like tumors. It becomes even more doubtful when we note that only malignant tumors of the suprarenal gland produce virilism, whereas adrenal-like tumors of the ovary are essentially benign.

Surely, there is no need here to discuss the theoretical possibility of luteinization in a pre-existent granulosa or theca-cell tumor in explanation of the origin of this masculinizing growth.

Authentic adrenal-like tumors of the ovary, so accurately described and discussed by Rottino and McGrath, and by Kepler, Dockerty, and Priestley, all seemingly develop within the substance of the ovary, as though produced by a perverted physiologic process, rather than originating as an independent growth. The capsule of an adrenal-like tumor is not a true capsule, but consists of a shell of ovarian tissue.

The assumption that a luteoma or adrenal-like tumor of the ovary is an epithelial growth originating from dormant cells and that it cannot arise from stromal tissue is contrary to the evidence of Zwemer, Wotton, and Norkus, who demonstrated that glandular cells of the adrenal cortex develop from fibroblast-like previously undifferentiated cells of the adrenal capsule. It is contrary, also, to Groat's experimental production of adrenocartical-like masses of cells from metaplasia of stroma cells or indifferent cells in the ovaries of adrenalectomized ground squirrels.

For the sake of greater clarity, let us quote from Maximow-Bloom:

"The interstitial connective tissue or stroma of the human ovarian cortex consists of a network of reticular fibers and spindle-shaped cells. . . . The cells of the ovarian stroma are probably not common fibroblasts, for they may give rise to interstitial cells. . . . Much has been written on the endocrine nature of the 'interstitial cells' of the ovary. . . . It is impossible to separate them experimentally from the other constituents of the ovary. . . . In the adult human ovary the interstitial cells are either absent, or present in small numbers as irregular cords of large polyhedral 'epithelioid' cells scattered in the stroma."

The inference is that interstitial cells may really be identical with ordinary ovarian stroma cells. In our case a direct sequence of transition from typical adrenal-like epithelioid cells to a spindle-shaped type of cells provided with intercellular fibers is clearly evident microscopically. It will be recalled that Schiller emphasized the importance of cell-connecting fibers in evidence that a tumor may be classified as of lutein origin, a feature characteristic of our tumor (Fig. 6), but not heretofore demonstrated in luteoma or adrenal-like tumor.

It would appear that adrenal-like tumor growths of the ovary arise by metaplasia of stroma cells or other indifferent cells rather than from embryologically misplaced tissue in the ovary. The growth is comprised of luteinized epitheloid and spindle shaped cells. Whether the cells which comprise the tumor are to be called epithelial is arbitrary.

From the accumulated facts now available, it seems that no distinction should be made between adrenal-like tumor and luteoma or luteinoma of the ovary.

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Discussion

DR. JOHN BREWER.—I should like to limit my remarks to the masculinizing tumor that Dr. Curtis has presented under the title "Adrenal-like Tumor of the Ovary." The primary objective of the presentation, which Dr. Curtis so ably made, is to demonstrate the origin of this type of masculinizing tumor. Many theories have been offered in the past and there has been much speculation, but no worker up to the present has given demonstrable proof concerning the origin.

The adrenal rest theory has certain deficiencies: (1) adrenal rests are not found within the ovary itself, and (2) transitional stages from adrenal rest tissue to this type of tumor tissues have not been shown.

The photomicrographs of transitional stages between stromal cells of the tumor and the epithelial-like cells comprising the tumor give conclusive evidence that this tumor arises from cells of the ovarian stroma. As far as I know, this is the first such demonstration. From the evidence we must accept the fact that this tumor arises from ovarian stromal cells.

With the origin of this type of tumor established, follow-up study and work will in the near future bring out all the salient features of this particular masculinizing ovarian tumor. The great confusion in nomenclature will be clarified and a single generally accepted name will evolve. Such fundamental work as this which has been presented is absolutely necessary as a basis upon which other facts can be built, and this eventually will enable us to reach a final and true understanding of an ovarian tumor which for a long time has remained obscure.

DR. CURTIS (Closing).—It is apparently evident, after study of this tumor, that it arose from metaplasia of stroma cells, or other indifferent cells of the ovary. There is no need to complicate the problem by assuming that the growth had its inception in embryonic rests: nor is there evidence that this was a preformed tumor which later became luteinized; discussion of luteinization serves merely to confuse the issue.

Granted that we have produced evidence that a tumor has been developed by metaplasia of normal cells, a really decided step forward has been made. Surely, other types of tumors may have similar origin from stimulation of apparently indifferent tissue cells. Discussion of the nature of such stimulation is not warranted without further evidence.

ARRHENOBLASTOMA OF THE OVARY*

Report of Two Cases

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CASE 1.—Mrs. V. N., aged 25 years, fair complexion, married five years, no children, no pregnancies.

Menstruation began at twelve years of age, was regular, 28-day type, and of five to six days' duration. There was some discomfort with the menstrual periods from the beginning, and this gradually increased in severity to the time where the pain was quite severe and required her leaving work for two or three days. At the age of twenty she noted that her menstrual periods were less in amount but of the same duration and interval. The dysmenorrhea became increasingly severe. At the age of 23 years her menstrual periods ceased and she had not menstruated for two years before coming for examination.

When the patient presented herself for examination the foremost complaint was dyspareunia, which was so severe that coitus was impossible for the last eight months. She attributed this to a growth between the labia which annoyed and irritated her at all times. The second complaint was voice change, which became so pronouncedly masculine that it necessitated her leaving the church choir. There had been a gain in weight of between 40 and 50 pounds in four years, and a growth of hair on face, arms, and legs. The failure to have children did not cause her much anxiety, and the amenorrhea was gratefully accepted because of the relief from menstrual pain. There was nothing remarkable in her childhood or adolescent history.

The general physical examination was negative. The breasts were large and pendulous. There was some regression of the areolae and nipples. Numerous follicles were present.

Pelvic Examination.—The external genitals were normal, except for enlargement of the clitoris which measured 7 cm. in length and 3.5 to 2 cm. in width, with a corresponding increase in the size of the overlying skin. The uterus was about normal size, upright, movable, and smooth. The left ovary and tube were normal. A tumor the size of a tennis ball occupied the site of the right ovary. It was semisolid, movable, and not tender. The cervix was normal. The internal os was normal. The uterine cavity was of normal length and the Fallopian tubes were patent.

A diagnosis was made of a masculinizing tumor of the right ovary.

She entered the hospital Jan. 24, 1944, and was operated upon on January 29.

The red blood count was 5,430,000, hemoglobin 17 Gm., leucocytes, 8,000. Wassermann reaction was negative. Urine was normal. The basal metabolism rate was minus 20. X-ray examination showed a definite shadow in the right lower quadrant. Photographs were taken of the genitals, the breasts, and the lower part of the face. A voice record was attempted, but was not successful.

At operation the pelvic findings were the same as found on examination, a tumor of the right ovary the size of a tennis ball, both tubes, left ovary, and uterus normal. No palpable pathologic changes were found in the upper abdomen. The right ovarian tumor was removed. The patient made a prompt recovery and left the hospital on Feb. 12, 1944.

*Presented before the Chicago Gynecological Society, Nov. 16, 1945.

Pathologic Report.—

Gross description: This slightly oval-shaped tumor measured 9½ by 8 by 6½ centimeters. It was smooth and quite regular. The color was a yellowish gray. The mass was quite firm, except over a very obvious cystic portion which occupied about two-fifths of the mass. This cystic portion of the tumor had a thin, tough wall opposite the solid portion of the tumor, and was filled with straw-colored clear fluid. The thin capsule which surrounded the entire tumor mass was apparently the remaining compressed ovarian tissue. The cut surface of the tumor was homogenous in appearance and of a light yellowish tan color. These surfaces remained smooth after cutting, except for some change in level between the coarse lobular divisions of the tumor. The solid portion of the tumor was flattened on the side of the cyst. Visible blood vessels were few except in the capsule which, as stated above, appeared to be a remnant of the ovary.

Fig. 1.—Moderately high power photomicrograph showing the irregular cords of cells which appear as tubules between which are more diffuse masses of similar cells and many less deeply stained masses of interstitial cells. Histologic diagnosis: Undifferentiated arrhenoblastoma of ovary.

Microscopic description: The epithelial arrangement of this tumor was less complicated than that of most of the tumors of this type. The only definite arrangement was in the form of zigzag cords of elongated cells which tended to extend at right angles to the direction of the cords. Right angle branching of these cords appeared to be a fairly characteristic feature. Narrow spaces appeared about these unit structures which ended in broad indistinct cords, which formed a network about areas of less deeply stained stroma where interstitial cells appeared. The stroma is quite vascular, and there was some suggestion that these blood vessels may have been continuous with the spaces about the cell cords. Nuclei were few in the stroma, except where interstitial cells were grouped. In some of the broader, more diffuse cords of epithelial cells there was the slightest suggestion of alveolar arrangement

of the epithelial cells, but one can say with fair certainty that definite alveolar or tubular arrangement was absent. It is remarkable that in a tumor showing so little differentiation in structure that interstitial cells should be so well developed.

Diagnosis.—Undifferentiated arrhenoblastoma of the ovary.

Postoperative Course.—On March 1, the patient had a normal menstrual period without pain, and on March 29, had a second normal period. There was a rapid change back to her feminine characteristics. When seen on June 17, there had been a weight loss of 24 pounds, the hair was falling from the face, arms, and legs, and her voice was much better. She was able to sing once more, and over the phone people no longer said "yes sir" to her. The clitoris was very much smaller and there was no dyspareunia. The red blood count was 4,120,000. The basal metabolism rate was plus 2.

She was seen again on Dec. 23, 1944, when she stated that her last menstrual period had occurred on October 23. Examination revealed a normal uterine pregnancy. The Aschheim-Zondek test was positive.

Under the care of Dr. William B. Serbin, she gave birth to a normal baby, weighing 7½ pounds, on Aug. 16, 1945, nineteen months after surgery.

At the present time (October, 1945) the breasts are normal, there is a free secretion of milk, and she is nursing the baby. She has none of the former masculine characteristics. The menstrual cycle is normal.

Case 2.—Mrs. S. S., aged 20 years, dark complexion, married two years, no children, no pregnancies.

Menstruation began at twelve years, periods were regular, three to five days' duration, and very moderate in amount. There was no discomfort or pain. Menstruation ceased in February, 1943, and had not recurred up to the time of consultation on Dec. 6, 1944.

The main points in her history, in addition to the amenorrhea and sterility, were a rapid gain in weight from 118 to 170 pounds in eighteen months, largely an abdominal disposition of fat, and a rapid and increasing growth of hair on the face and body. She had to use a depilatory on the face every morning because the beard was so heavy. She had had intensive endocrine therapy for one year before consultation.

The general physical examination was normal, except for very large pendulous breasts and an exceedingly large, firm abdomen.

Pelvic examination showed the clitoris enlarged to three or four times normal size. The vulva, vagina, and cervix were normal. The left adnexa or fundus of the uterus could not be palpated. The right ovary was palpable and enlarged, but receded from the examining finger so that estimation of size was not possible.

The Wassermann reaction was negative. The red blood count was 5,510,000, the hemoglobin 16.5 Gm. (103 per cent). The urine was normal. The basal metabolism rate was minus 18. The Aschheim-Zondek test was negative. An x-ray examination of the abdomen gave no help in this case.

Surgery was advised because of the evidence at hand, and because of the great similarity of the laboratory findings to those in the first case. Operation was performed on Jan. 20, 1945. The uterus was about normal in size, shape, and consistency. The right and left tube and left ovary were normal. The right ovary was the size of a golf ball or small plum, of normal color and prolapsed. It was firmer than normal and slightly larger at the hilum. The ovary was removed. The patient made a good recovery and left the hospital January 28.

Pathologic Report.—

Gross description: The ovary was slightly larger than a golf ball and was oval in shape and firm in consistency. The surface was regular, except for small cysts which bulged slightly from the surface, mostly on one side. The surface was of a translucent gray color. A cut through the center of the ovary revealed the presence of a rounded, sharply demarcated tumor mass which occupied most of the ovary. The tumor mass was homogenous in appearance and of a light yellowish tan color. It was not encapsulated from the ovarian substance which formed a bordering zone about the tumor measuring from 2 to 8 mm. in thickness. The small cysts in this ovarian tissue contained clear fluid. The tumor bulged from the cut surface, and lobular division of the tumor was indicated by a granular appearance of the cut surface.

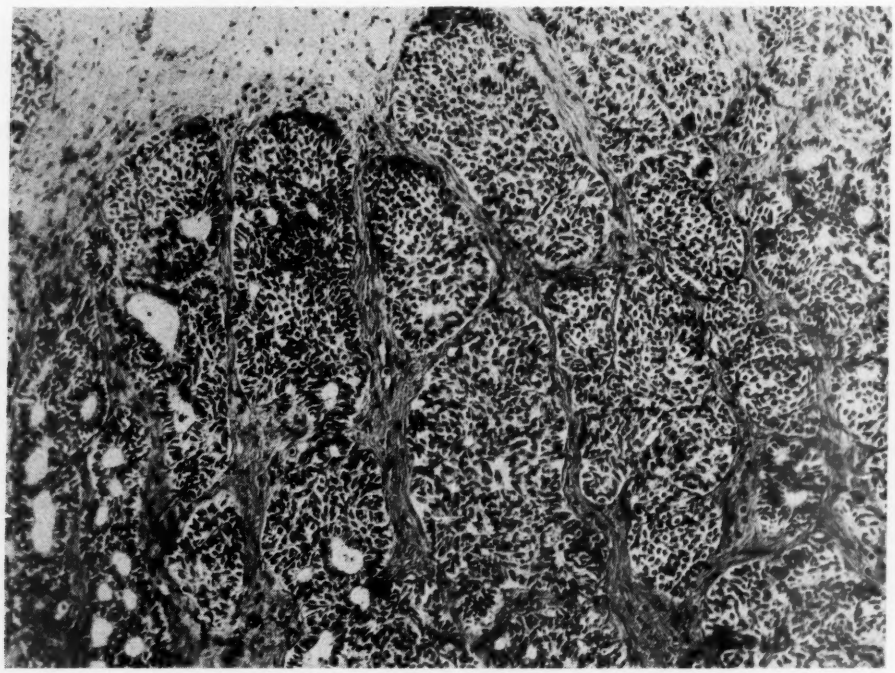

Fig. 2.—Moderately high power photomicrograph showing broad, radially arranged cords of epithelial cells composed of mixed acinar structures and more or less obscure tubules or solid masses of cells. Note practically complete absence of the interstitial type cells. Histologic diagnosis: Highly differentiated arrhenoblastoma of ovary (testicular adenoma of Pick).

Microscopic description: Rather broad irregular cordlike masses of deeply stained tumor cells were composed of both acinar or tubular structures and other groups of tumor cells which did not appear to have any particular arrangement. The cells did not vary much in size, and the shape varied from rounded to angular or slightly spindle shaped. The nuclei were nearly all central, and had a pyknotic appearance. The nuclei tended to assume the shape of the individual cells. In places the epithelial positions of the tumor narrowed down to cords which took a zigzag course through bordering zones of fairly dense fibrous stroma. The cells of these narrow cords were arranged at right angles to the direction of the cords. Lumens could not be demonstrated in the cords, but some of the cords appeared to end rather abruptly, in small acini. The stroma of the tumor was simple, and appeared to be quite dense, although the nuclei of the stroma cells maintained the oval shape typical of newly formed fibrous tissue.

The bands of stroma varied greatly in thickness from the wide bands which roughly divided the epithelial cords or masses, to narrow strands which tended to cross the epithelial cords dividing them into blocklike areas.

Interstitial cells could not be recognized in any of the sections. The ovarian tissue about the tumor mass contained primordial and developing follicles.

Diagnosis.—Highly differentiated arrhenoblastoma of ovary. Testicular adenoma of Pick.

Postoperative Course.—On February 1, there was a bloody discharge from the vagina for one day. On March 5 she had a regular menstrual period, flowing a good amount for five days. Periods have recurred regularly since that time. There has been a loss of 50 pounds in weight up to Sept. 10, 1945, without any special care or diet. There are large areas of alopecia on the face and body.

Discussion

Both of these patients had similar signs. The undifferentiated tumor showed more effect on the external genitals than the differentiated growth, possibly due to its being five years older. The growth of hair was much more abundant and there was much more gain in weight, but with very little difference in the metabolic rate in Case 2. Both patients had high red blood counts, which is not consistent with the low metabolic rate and the large gain in weight. These, I think, are important signs in diagnosis of these growths, and particularly in young, healthy individuals. Bingle mentioned polycythemia in these cases but could offer no explanation for it. The response to surgical removal of the ovarian tumors was very prompt and very gratifying in both patients.

Addendum

CASE 2.—May 8, 1946, a normal pregnancy of approximately thirty-two weeks' duration.

250 EAST SUPERIOR STREET

ANOTHER CASE OF ARRHENOBLASTOMA*

ARTHUR H. CURTIS, M.D., CHICAGO, ILL.

(From the Department of Obstetrics and Gynecology, Northwestern University Medical School, and Passavant Memorial Hospital)

OVARIAN tumors arising from male directed cells tend to cause masculinization in previously normal women if the tumor contains cells which elaborate the male sex hormone; this has occurred in nearly one-half of the reported cases of arrhenoblastoma; in fact, symptoms of virilism are almost a prerequisite in the establishment of a diagnosis. Defeminizing phenomena, such as amenorrhea and decreased size of the breasts, occur in some cases.

Arrhenoblastoma is a rare tumor. Sixty-odd cases have been recorded in the literature.

Grossly, these tumors are often like granulosa-cell tumors but tend to be more nodular. They are almost always unilateral (mine was bilateral), are mostly solid, the cut surface frequently necrotic or hemorrhagic.

The various growths differ according to the stage in which development was arrested. The three arbitrarily distinguished types are (1) the highly differentiated testicular adenoma of Pick, (2) the undifferentiated, chiefly sarcoma-like, functionally most active growth, diagnosed by rudimentary tubules and sex-like cords of cells, (3) the intermediate group, of large size and presenting great variation in structure, occupying a midposition as to function. Our tumor belongs in the last-named group.

An arrhenoblastoma may be small, but it is usually readily palpable. The relatively benign character of the growth merits emphasis, even in those cases with a sarcomatoid structure.

Case Report

I. C. (No. 3639), aged 52 years, the mother of two mature sons, and a widow for three years. The last menstruation occurred six months previously, and for the same period of time there had been hoarseness of the voice. Gradually increasing distress and fullness of the abdomen had been present for some months, but there was no pain until one week prior to consultation.

Marked hirsutism and deep huskiness of the voice were at once apparent. Hypertrophy of the clitoris and the enlarged abdomen suggested the probability of an arrhenoblastoma, even before bimanual examination. Abdominal and pelvic palpation revealed solid tumors, apparently of ovarian origin, which filled the pelvis and abdomen to above the level of the umbilicus. A uterus of essentially normal size was palpable, separate from the freely mobile tumors.

At operation, Oct. 12, 1943, both ovaries were found converted into solid tumor masses, each the size of a child's head. A plum-sized pedunculated myoma sat atop a well-placed uterus of normal size. Both tubes were normal. Palpation of the other abdominal viscera revealed one large stone in the gall bladder, a markedly indurated pancreas, and somewhat indurated kidneys. The entire uterus, both tubes and ovaries, and the appendix were removed.

*Presented at a meeting of the Chicago Gynecological Society. Nov. 16, 1945.

Pathologic examination of the tumorous ovaries revealed two massive ovoid growths of almost identical size measuring 17 by 18 by 9 cm., and 17 by 13 by 10 cm. (Fig. 1).

The external surfaces of the two firm growths were markedly but smoothly nodular, with glazed milky tissue beneath the capsule in many areas, as from distended lymphatics. The color as a whole was bright red to dull cherry-red,

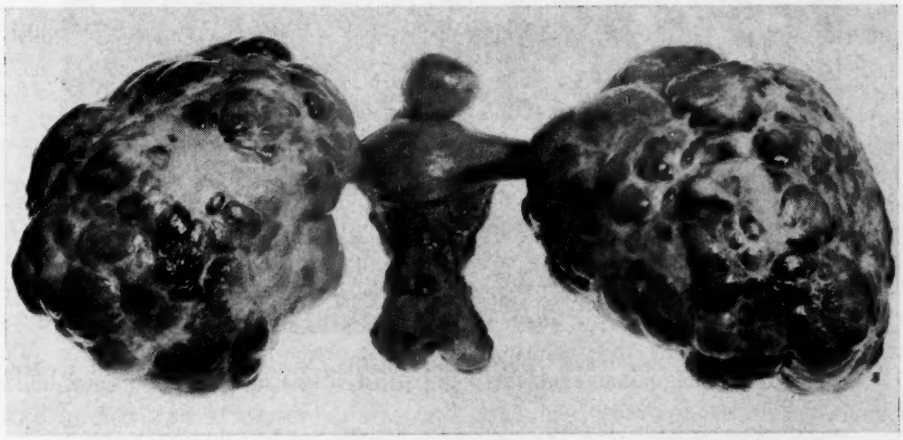

Fig. 1.—Arrhenoblastoma, case 3639. Photograph of uterus (myoma atop fundus) together with two ovarian tumors measuring 17 by 18 by 9 cm. and 17 by 13 by 10 cm.

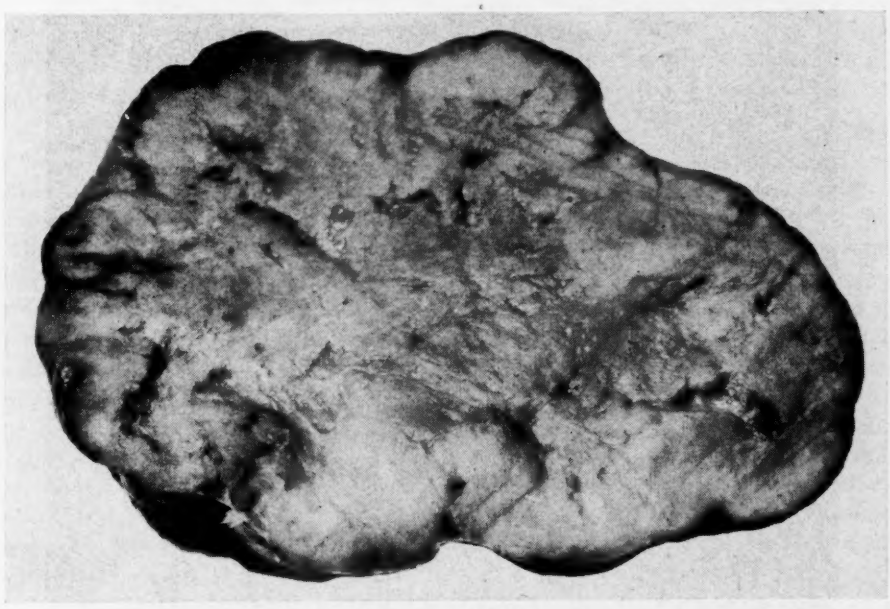

Fig. 2.—Case 3639. Cut surface of bisected arrhenoblastoma of ovary. 17 by 18 by 9 cm.

some areas gray-white. Nowhere was there surface ulceration, although there were many projecting minute nodules as well as large ones up to 5 cm. in diameter.

The cut surface of one bisected tumor (not illustrated) had many geographically irregular, extensive areas of gelatinous softening, in distinction from the one shown in Fig. 2, which was only slightly necrotic. The tumor

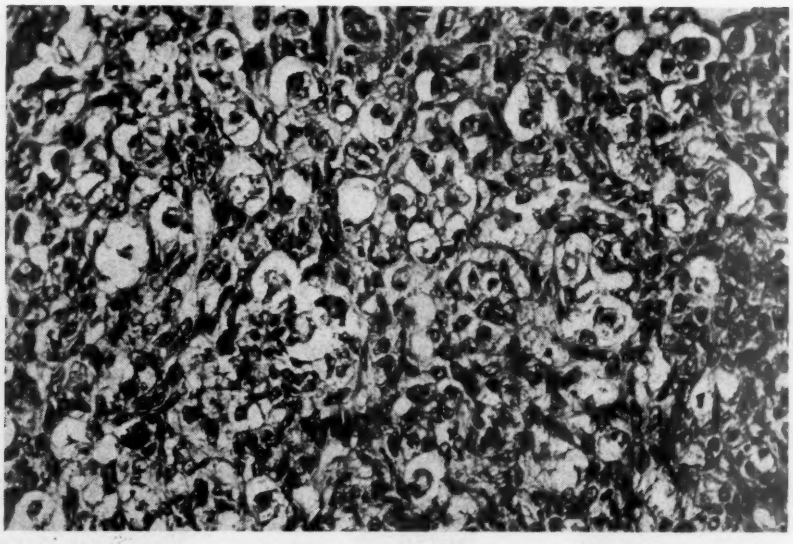

Fig. 3.—Arrhenoblastoma, case 3639. Diffuse sarcoma-like structure with slight tendency to tubule formation, characteristic of major portions of both tumors. (×200.)

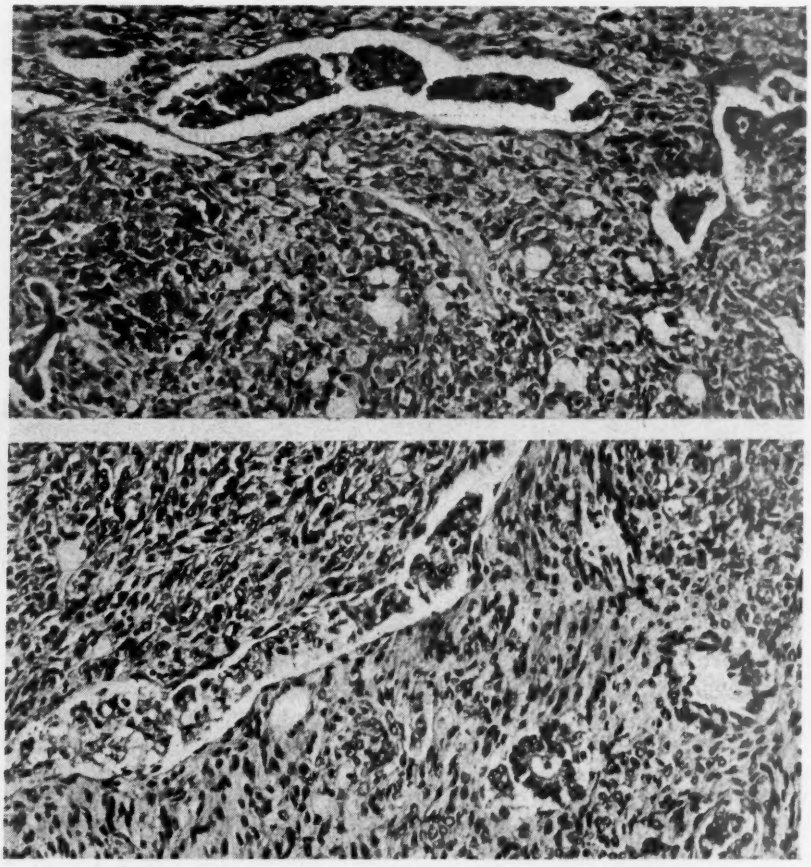

Fig. 4.—Arrhenoblastoma, case 3639. *Above.* Epithelial proliferation of solid strands, cords of cells and slight tubule formation, intermingled with a diffuse sarcoma-like growth. (×120.) *Below.* One solid strand and some minute cords and clusters of cells, also several atypical tubules, merging into a sarcoma-like and less malignant spindle-cell growth. (×132.)

tissue as a whole, although quite firm, was raw fish- or brain-like, gray-white, in some areas more vascular, almost telangiectatic. On the whole, the cut surfaces of the two tumors did not differ enough to merit separate descriptions.

The microscopic structure presented mostly a richly cellular alveolar configuration, the cells large and irregular, mostly oval (Fig. 3). This massive expanse of sarcoma-like tissue merged here and there with irregular tubules and cords of epithelial cells, some with a distinct lumen, others in solid strands, thus identifying the growth as an arrhenoblastoma belonging to the intermediate group (Fig. 4). The oft-repeated statement that gradation from the sarcoma-like cells directly traceable to epithelial cords demonstrates the epithelial origin of the tumor is open to question, for one finds also, as with theca cell tumors, a definite transition from the richly cellular growth to spindle-shaped stroma cells, richly cellular fibrotic tissue constituting a considerable portion of the tumor structure. It would appear, as with thecoma tumors, that it is immaterial whether the cells are sarcomatoid or definitely epithelial. Whether they arise from embryonal rests of mesenchymal origin, or from perverted growth of stromal elements, or owe their origin to one-sided development of a teratomatous tumor, is undetermined.

The massive size of the tumors is characteristic of the intermediate group of arrhenoblastoma. As stated, a bilateral growth is unusual.

The uterus was of generous size and contained two subserous myomas, the larger the size of a walnut. The opened uterus was of normal proportions except that the cervix constituted nearly one-half of the uterine length. In conformity with the usual tendency in this disease, the endometrium was more atrophic than normal in a patient only six months beyond her last menstruation.

The patient has had an uneventful clinical course since the time of operation. The voice has modulated, hypertrichosis has largely disappeared, and the clitoris has returned to normal size.

Discussion

DR. GEORGE H. GARDNER.—Dr. Curtis' presentation of his adrenal-like tumor and his discussion of the accompanying problems, is an illuminating résumé of all that is now known about such tumors. Obviously, there are many features which are not yet well understood and which cannot be settled now with certainty. However, I am quite willing to accept the interstitial cells of the ovary as the origin of such adrenal-like tumors. On the other hand, I still am confused and a bit perturbed by the terms luteoma and luteinoma, and since world authorities doubt the existence of such tumors, probably the hypothetical luteoma and the nebulous luteinoma should be omitted both from the literature, and from our discussions. Although it is an acknowledgment of weakness, nevertheless it is a fact that, for the accurate identification of many unusual ovarian tumors, more is necessary than the mere histologic study of hematoxylin and eosin stained sections of these tumors. One must have additional information, namely, the clinical history of the patient and the benefit of special staining techniques to bring out distinctive features of tumor cells in order to arrive at a final diagnosis.

I wish to take this opportunity to bring to the Society's attention and to solicit your support for a project which was fostered by the American Gynecological Society in 1942. At that time an Ovarian Tumor Registry was established, and a Committee was appointed to study and classify ovarian tumors as they were submitted to this Registry. It was hoped thereby to accumulate a volume of material which would permit a better understanding of many ovarian tumors. The Chairman of this Committee is Dr. Emil Novak; consequently, at present, this Ovarian Tumor Registry is located in Baltimore. Among others the Committee includes Dr. Robert Meyer. Up to the present time only about 150 tumors have been submitted for survey, and I might add that very few have come from the Chicago area, even though the

Registry and the work of this Committee has received favorable publicity in both the *Journal of the American Medical Association* and the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY. I look upon this Ovarian Tumor Registry as a potent source for important contributions to our knowledge of gynecologic pathology. This Registry is already rendering a fine service, and will permit our knowledge of ovarian tumors to expand with greater rapidity.

DR. VICTOR D. LESPINASSE.—I happened to read in a recent number of the *British Journal of Obstetrics and Gynecology* of a patient who had an arrhenoblastoma of the ovary becoming pregnant. When the baby was born it was a female, deformed in the same way that Dr. Greene's female rats were deformed when he injected testosterone into the mother. The deformity is a good deal like hypospadias in the male. It is interesting to see what an increased amount of testosterone will do in a pregnant woman. The patient reported in the British *Journal* did not have a very large clitoris. She had a good sized tumor and abundant facial and body hair.

DR. MARK T. GOLDSTINE.—Gynecologic pathology is a most interesting type of work and it requires that the clinician himself supervise and care for his own specimens.

As far as the outline of the tumor is concerned, I think this tumor is not of morphologic origin. I think the tumor originated in the ovary itself, and that it arose from the ovarian tissue.

LARGE OVARIAN CYST

Report of a Case

F. J. HOFMEISTER, M.D., MILWAUKEE, WIS.

(From the Milwaukee Hospital)

THE patient, Miss H. M., aged 58 years, was first seen in July, 1944, with a greatly distended abdomen. Her weight was 264½ pounds. The circumference of her abdomen was 62 inches.

This tremendously distended abdomen had been present thirty-four years, and had increased in size more rapidly in the last three years. She had been treated over this period of time by various reputable physicians for conditions varying from pulmonary tuberculosis with peritoneal tuberculosis, to decompensated heart disease. When first seen she was taking digitalis and using Salyrgan suppositories to reduce the "abdominal ascites."

Examination revealed the heart and lungs to be normal. The blood pressure was 122/75. The urinalysis and complete blood count was normal. A chest x-ray was normal. A gastrointestinal x-ray revealed the intestines displaced into the upper abdomen. The abdominal wall was so distended and so thin that the abdominal cavity could easily be transilluminated using a flash light. Large, distended, tortuous varicosities were present in the abdominal wall. The percussion note of the abdomen was dull. There was a distinct fluid wave. No shifting dullness could be elicited. There was little ankle edema, but varicose veins and small varicose ulcers were present on the extremities.

A diagnosis of probable ovarian cyst was made. Because of the tremendous distention, slow decompression to be followed by exploratory laparotomy was the treatment decided upon. This decompression was done by means of an indwelling, plain rubber catheter inserted through an ordinary trocar. Drainage was carried out over a period of fifty-six days in amounts varying from 1,000 c.c. to 1,500 c.c., depending upon the patient's condition. By the end of this 56-day period of time, 78,840 c.c. of fluid were removed. Six days after the final drainage, an exploratory laparotomy was done through a small midline laparotomy incision to first verify the presence of a cyst wall. This incision was then enlarged, dense adhesions to the abdominal walls and the abdominal viscera were freed, and a collapsed cyst was delivered. The origin of the cyst was in the left ovary. The remainder of the pelvis was left intact, 100,000 units of penicillin was instilled into the abdomen, and the abdomen was closed. The patient made an uneventful recovery, and was discharged from the hospital on the fifteenth postoperative day, weighing 100 pounds.

The thickened wall of the cyst was opened and was found to be unilocular, and contained an additional 2,000 c.c. of fluid. The fluid was green, opalescent, and serous in nature. The specific gravity was 1.028. The total protein was 7.15 grams. There were no tumor cells or bacteria found microscopically, and there was no growth on the culture plates. The microscopic sections of the tissue revealed a fibrous cyst wall containing few glandular elements. A diagnosis of benign, unilocular, serous cystadenoma was made.

The patient was last seen in February, 1945. She weighed 140 pounds and was living a normal life, after having been a semi-invalid for thirty-four years.

*Presented at a meeting of the Chicago Gynecological Society, Nov. 16, 1945.

Summary

The total fluid removed during the fifty-six days and at the time of operation was 80,840 c.c., and weighed two hundred and twenty-three pounds. The difference of weight between the weight loss from the time of admission to the time of discharge and the weight of the fluid removed is due to the fact that there was a reaccumulation of fluid during this 56-day period. Unfortunately, the cyst wall was not weighed. However, it is safe to regard the combined weight of the cyst wall and fluid as in excess of 164 pounds.

This report is not primarily presented because of the size of the ovarian cyst, but in view of the interesting problem created because of the length of time that this patient's condition was undiagnosed, and the fact that she was treated for the conditions mentioned.

3254 North 54th Street

AN UNUSUAL CASE OF RUPTURE OF THE UTERUS WITH MASSIVE HEMORRHAGE*

R. GORDON DOUGLAS, M.D., NEW YORK, N. Y.

(From the Department of Obstetrics and Gynecology, New York Hospital and Cornell University Medical College)

THE amount of bleeding associated with rupture of the uterus varies from minimal amounts on some occasions when the trauma occurs at the site of a previous operation to sudden and profuse hemorrhage in other cases which may be intra- or retroperitoneal. A recent composite statistical report by Morrison and Douglass[1] cites an average mortality of 50 per cent. Such reports, because of the infrequency of the complication, include patients with this accident that occurred one, two, or more decades ago. The inclusion of only the more recent cases would undoubtedly reveal a considerable decrease in this mortality figure. Our own experience during the past thirteen years in the New York Lying-In Hospital includes 19 instances of this accident in approximately 45,000 term and premature deliveries, an incidence of 1 to 2,388 cases, with a mortality of 3, or 15.8 per cent.

Rupture at the site of previous operation, at the time of version, following the administration of oxytocics, injudicious instrumentation, and spontaneous instances constitute the most common causes. Complete intraperitoneal rupture can most frequently be diagnosed, while the incomplete or complete retroperitoneal types may be unrecognized. Accidents similar to the case to be described have probably occurred; however, in a review of the recent literature I have not been able to find a report with circumstances quite comparable.

Case Report

A 42-year-old white woman, gravida vii, para iv, was admitted for the sixth time on the evening of Aug. 20, 1945, at term, giving a history of moderate vaginal bleeding during the afternoon, followed by low back and abdominal pain.

The history is of interest. In 1938 at the age of 35 years, following a normal pregnancy, she was delivered of her first baby without difficulty by low forceps following a fifty-hour labor. The placenta was retained and, because of bleeding, it was removed manually, at which time it was found to be adherent to the posterior and superior wall and right cornu. Recovery following transfusion was uneventful.

The following year during labor she was found to have a face presentation (right mento transverse). It was impossible to manually rotate the head and accordingly delivery was accomplished by midforceps rotation and extraction. The baby weighed 4,000 grams. Two years later (1941) she was found to have a brow presentation which was converted to a face, and followed by spontaneous delivery. In both 1942 and 1943 uncomplicated spontaneous abortion occurred. In 1944 she was delivered of a stillborn infant at term in another hospital.

During the evening following admission only very slight vaginal staining was noted, but pronounced changes in the rate of the fetal heart tones were soon noted. In addition, the tonicity of the uterus increased. A diagnosis of partial premature separation of the placenta was made, and a decision to effect delivery as quickly as possible in the interests of the child by cesarean section was reached. Under nitrous oxide-oxygen anesthesia the abdomen was opened and the uterus found to be somewhat rotated to the right but not otherwise

*Read at a meeting of the New York Obstetrical Society, Nov. 13, 1945.

remarkable. A low classical incision was made in the midline. Four hundred cubic centimeters of blood clots were encountered and, because the head could not be delivered easily employing the hand as a vectis, the feet were grasped and a living infant extracted at 12:35 A.M. Aug. 21, 1945. It was estimated by subsequent measurement of clots that during a period of three minutes the blood loss totaled at least 3,000 cubic centimeters. During this time the placenta, which was partially separated anteriorly, was removed manually with some difficulty from its attachment on the right side. Intravenous pitocin was given as the baby was extracted, and five to ten minutes later the uterus contracted satisfactorily and the hemorrhage appeared to be controlled. The uterus was closed in layers and no bleeding or other abnormality was noted. Accessible clots and free blood were removed from the peritoneal cavity, although it was definitely felt that there was some free blood left in the upper abdomen. The abdominal wall was closed in layers with catgut and, because of haste, no stay sutures were employed. The skin was approximated with interrupted black silk sutures. The operation was accomplished in twenty-eight minutes.

Concurrently with the hemorrhage, profound shock rapidly developed. The radial pulse could not be palpated nor the blood pressure obtained. Respirations were shallow and accordingly the anesthesia was stopped and oxygen administered. Simultaneous infusions of whole blood and plasma were immediately started, and within forty minutes of the delivery of the baby 1,000 c.c. of blood and 500 c.c. of plasma had been administered under pressure. A temporary response occurred, but deep and prolonged shock again developed which had all of the signs and symptoms of the irreversible phase of this condition. During the first hour following operation 250 c.c. of clots were expressed from the vagina; thereafter the vaginal bleeding was somewhat excessive for a few hours, but because of a firm fundus at all times other than oxytocics, further investigation or therapy for this condition was not carried out. Replacement and supportive therapy were continued and by 9:00 A.M., eight and one-half hours after delivery, the patient had received 3,000 c.c. of whole blood, 2,000 c.c. of plasma, and 1,200 c.c. of saline as a vehicle, a volume equal to the total calculated blood volume at the time of operation, and for the first time she had definitely recovered from a state of shock. Supportive measures included oxygen by inhalation, external heat, vitamins K and C, adrenal cortical hormone, stimulants, digitalization, and tourniquets applied to the upper thighs. At noon the hematocrit was found to be twenty. There was no abnormal vaginal bleeding and no signs of intraabdominal hemorrhage, and the fundus remained well contracted. Because of the low cell volume an additional 500 c.c. of blood were given. One thousand cubic centimeters of 1/6 molar lactate was administered to combat the acidosis of shock and to minimize any possible kidney damage resulting from blood incompatibility. Additional blood was given three days later because the hematocrit was 21 and the hemoglobin 6.5 grams. There was no apparent satisfactory explanation for these disturbing low figures.

On the fifth day after the cesarean section, oozing of dark blood was noted from the upper portion of the incision. Further investigation immediately revealed a definite wound disruption. The abdomen was reopened and considerable old dark free fluid blood was aspirated; it seemed obvious that it had been there since the first operation. The uterus was pushed far over to the left side. The site of incision in the uterus appeared to be healing satisfactorily and the right broad ligament contained a hematoma completely filling the lower abdomen up to the level of the umbilicus. After evacuating the old free blood it was conclusively decided that there was no intraperitoneal bleeding whatsoever. The posterior layer of the broad ligament was opened. Exploration revealed a complete intraligamentary rupture of the uterus 9 cm. long. The

relationships are illustrated in Fig. 1. Approximately 2,200 c.c. of blood was evacuated from the broad ligament and peritoneal cavity, and a hysterectomy was performed. The specimen is illustrated in Fig. 2. Satisfactory peritonealization was accomplished despite the friable edematous condition of the right broad ligament. A Miller-Abbott tube was inserted and the abdomen was closed in layers with catgut, reinforced with silver wire stay sutures. During the operation 1,000 c.c. of whole blood was administered.

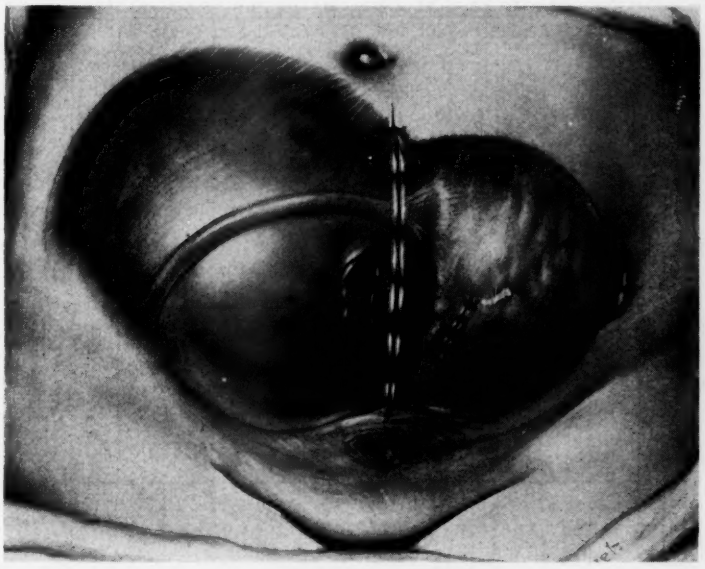

Fig. 1.

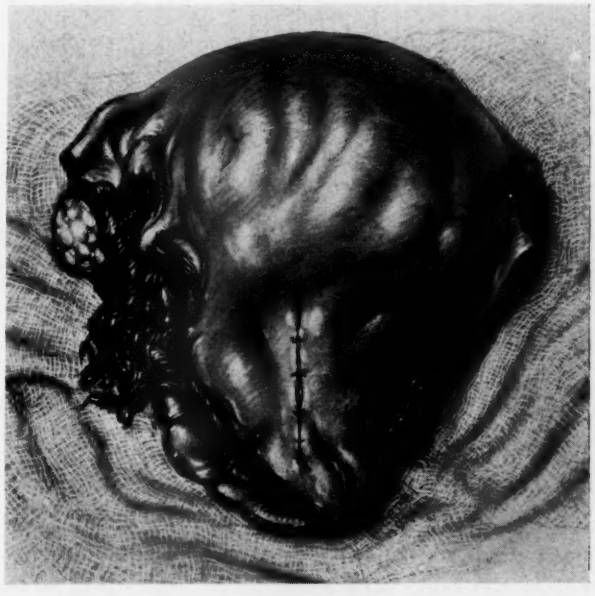

Fig. 2.

Figure 3 illustrates the blood loss and replacement and the hemoglobin, red blood count, and hematocrit levels. No essential change is noted during the period between the operations when bleeding presumably was occurring into the retroperitoneal space. A prompt rise in these curves thereafter is evident with

a return to normal by the eighteenth day following the second operation, at which time the patient was discharged from the hospital completely recovered.

During the postoperative course the patient received approximately 2 million units of penicillin, 70 Gm. of sulfadiazine, supplementary vitamin therapy, and other supportive measures.

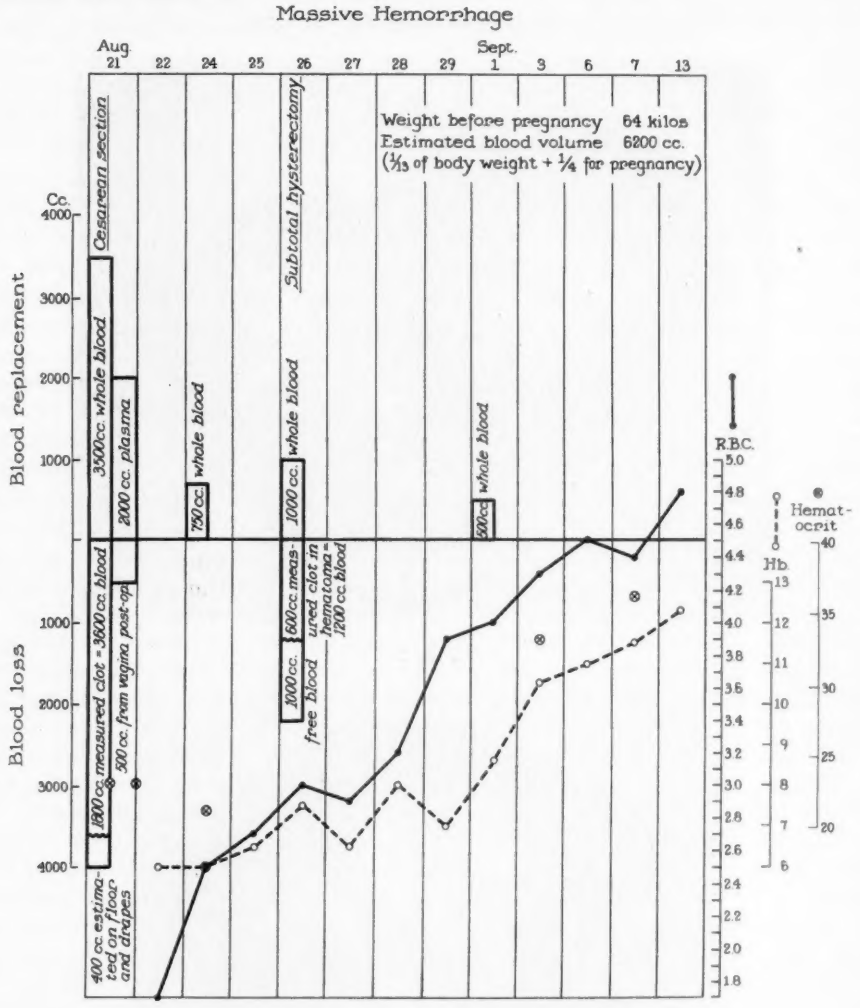

Fig. 3.

Pathologic examination of the uterus failed to reveal any possible cause for the rupture. The site of the cesarean section scar was only 4 cm. in length, with microscopic evidence of satisfactory healing. The uterine tissue in the region of the laceration showed some necrosis, hemorrhage, edema, and myometritis.

Discussion

Data concerning the time and etiology of the rupture create the most interest. Several important questions might be asked, i.e.: Was the rupture spontaneous and probably incomplete and responsible for the initial symptoms requiring hospitalization? Did the patient have a partial premature separation of the placenta and did the rupture occur at the time of operation? Were there

anatomic changes in the uterus following the previous unusual obstetric history, and, if so, did such pathologic anatomy predispose to the present accident? From a consideration of the available facts which, of course, does not preclude other possibilities, it would appear that the most likely explanation is somewhat as follows: The initial symptoms were caused by a small area of separation of the placenta. Following hospitalization and during observation this area increased in size until signs of fetal asphyxia and increased tonicity of the uterus developed. The presence of clots in the uterus indicated a partial separation, but, of course, did not preclude the presence of an incomplete rupture. The initial hemorrhage was of such massive proportions that the placenta was removed manually with difficulty, and the blood prevented this being done under direct visionary control. It would, accordingly, appear that the patient had a partial premature separation of the placenta with a portion of the remainder unusually adherent. During the process of separation the muscle of the uterine wall was traumatized. The size of the rent may have increased post partum because of the hematoma that subsequently developed.

The hemorrhage occurred from large vessels in the incision and from the placental site. It was promptly controlled by the retraction of the uterus and the general circulatory collapse. The sense of some degree of security by having an infusion running and blood available in the operating room on such an unpredictable occasion can well be imagined. The prompt employment of large quantities of blood and plasma administered through multiple sites with a maximum gravity effect, and pressure if necessary, is absolutely essential in the management of such emergencies. The development of secondary shock and the subsequent failure of the hemoglobin, red blood cell count, and hematocrit to rise suggested additional blood loss. A second operation, or vaginal examination, however, did not appear indicated because of the absence of signs of intraperitoneal or vaginal hemorrhage, and the reasonable satisfactory condition of the patient until the wound disruption on the fifth postoperative day. The subsequent prompt and progressive rise of these blood factors followed a very satisfactory course.

The urgent necessity for blood in this patient developed within a matter of three minutes and, because of routine preparations, it was possible to start replacement almost immediately. Reliance upon a single intravenous apparatus which is subject to failure upon such occasions does not provide the patient with all means at hand to insure her recovery. Molar lactate solution should be administered through one of the infusion sets as soon as practical to render the urine alkaline which will minimize untoward effects on the kidneys in the event of blood incompatibility, which is always possible when many bloods from different sources are employed.

Summary

A case report is presented of a patient operated upon for partial separation of the normally implanted placenta. Massive hemorrhage (3,000 c.c.) occurred within a matter of three minutes after opening the uterus. The placenta had to be removed manually, and it would appear that the uterus was unknowingly ruptured during this procedure. The initial measured blood loss was in excess of one-half the estimated blood volume, and simultaneous replacement of blood and plasma by multiple transfusions during the day of operation represented eight-ninths of the estimated blood volume. The calculated blood volume of the patient at the time of operation was 6,200 cubic centimeters. The total blood loss was estimated at 5,700 cubic centimeters and the replacement of blood and plasma amounted to 7,750 cubic centimeters.

Conclusions

1. The uterus can be ruptured during manual removal of the placenta at the time of cesarean section.

2. An infusion should be administered during cesarean section and blood available to add immediately in case of an emergency.

3. In the event of serious hemorrhage, multiple simultaneous transfusions administered under pressure, if necessary, provide a margin of safety not otherwise obtainable.

Reference

1. Morrison, J. H., and Douglass, L. H.: Am. J. Obst. & Gynec. 50: 330, 1945.

Discussion

DR. HOWARD C. TAYLOR, JR.—We have recently had a case of rupture of the uterus at Bellevue Hospital which raises some interesting points in connection with the physiology and pathology of hemorrhage after delivery.

This particular patient was delivered by midforceps early one morning and suffered a rupture of the uterus as a result. The rupture was not recognized for about three hours, when a mass appeared above the symphysis on the left side and gradually increased in size. As the patient appeared to be in only moderate shock and the operating rooms were fully occupied at the time, surgery was delayed for about an hour and a half more. Undoubtedly she bled a good deal during this time.

During the course of the hysterectomy which followed the blood pressure dropped so that for some minutes the pulse was imperceptible to the anesthetist. During this time the tissues took on a very dark color, and the uterine arteries at the time of their ligation were found impressively constricted.

This patient recovered, but she undoubtedly suffered severe permanent damage in several organs as a result of this period of lack of oxygen. She remained more or less comatose for about three days. During this time her urinary output dropped very low, and on the fifth day there was noted a considerable elevation of the nonprotein nitrogen of the blood. The patient also became permanently blind in one eye.

Renal function tests were undertaken about a week after the hemorrhage. The glomerular filtration rate and the renal blood flow were found to be only 50 per cent of normal. On a second examination about six weeks later these functions had returned to about 75 per cent of normal.

This patient apparently falls into a group in which severe hemorrhage and shock are associated with a temporary anoxia, formerly usually fatal, but now capable of successful therapy, as a result of prompt replacement of blood. In a few such cases, however, recovery will not be complete, because permanent damage will have occurred during the period of acute oxygen lack. The areas most susceptible appear to be in particular brain tissue, renal tissue, and perhaps the pituitary gland.

The case is perhaps important because it suggests that the effect of hemorrhage is not always limited to the acute episode. It is possible that in many other cases less easily recognizable, but perhaps significant, injury occurs.

The patient is presented as one who went through an episode somewhat similar to that reported by Dr. Douglas, but one in which the subsequent permanent injury was sustained.

BILATERAL CONCOMITANT FIBROMA AND SEROUS CYSTADENOMA OF THE OVARY

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NO SATISFACTORY basis for the classification of ovarian tumors has yet been established. Pfannenstiel, Goodall, Olshausen, von Franqué, Waldeyer, Geist, and many others have attempted a classification, and the many efforts expended are mute testimony that each is lacking. The case herein reported presents an unusual combination of ovarian tumors, a fibroma, and a serous cystadenoma in each ovary. A diligent search of the literature has revealed rare mention of such a combination, and since the knowledge of the histogenesis of ovarian tumors leaves much to be desired, it appears timely to report the following case.

Case Report

Mrs. H. P., a 70-year-old married woman, was admitted to the service of Dr. Copland on Aug. 21, 1943, with a complaint of swelling of the abdomen.

Present Illness.—About ten months previous to admission the patient noted that her dresses were becoming too small in the waist, yet she was not becoming any larger elsewhere in her body. Her stomach continued to grow larger and larger and she thought that if she had not changed life years ago, she might be pregnant. There was no pain associated with the enlargement of the abdomen, which now appeared to be the size of a full-term pregnancy. There were no gastrointestinal symptoms or swelling of the feet or ankles. There had been some shortness of breath in the past three months, and the patient noticed that she was more comfortable on a back rest. No veins on the abdominal wall had become more prominent, nor had the patient developed any hemorrhoids.

There had been no serious illnesses or previous operations. She had been married fifty years, had had four children, no miscarriages. She had had arthritis with the last pregnancy, and the child was born with "sore eyes." Menopause occurred at 45 years of age. During menstrual life there was no dysmenorrhea, menorrhagia, or metrorrhagia. No vaginal bleeding had occurred since menopause. The family history was negative for diabetes, tuberculosis, malignancy, syphilis, or nervous disorders. No women in the family had had a similar swelling of the abdomen.

Physical Examination.—The patient's blood pressure was 170/90; temperature, 98.6° F.; respiratory rate, 22; pulse rate, 75. The patient was a well-nourished woman weighing 170 pounds, and about 5 feet 8 inches in height. She did not appear acutely ill or depressed. The relevant physical findings were: Abundant amount of grayish-white hair; some mild temporal artery sclerosis; glasses for myopia; mouth edentulous; wears upper and lower plates; chest, few coarse râles over right base. The heart was not enlarged. The abdomen was very much enlarged with rounded contour. Skin was tense. No varicosities of abdominal wall. Mass in right side of abdomen as large as a watermelon. Vaginal examination showed a senile vaginal atresia. Rectal examination essentially negative. Extremities, several varicosities of both legs but not severe; posterior, tibial, and dorsalis pedal vessels were easily palpable.

Clinical Course.—Operation was performed on Aug. 23, 1943. Under ethylene-ether anesthesia a midline subumbilical incision was made through the skin and subcutaneous tissue. Enormous distention of the abdominal wall had already retracted the rectus muscles laterally. The peritoneal cavity was opened. The only structure visible was an enormous cyst wall, and it was estimated that the cyst weighed about 20 pounds. An aspirating trocar was inserted into the cyst wall and about three quarts of a clear and slightly straw-colored fluid was aspirated. A slight amount of free peritoneal fluid was also present. The cyst had developed from the left ovary, and the left ovary and tube were resected. This specimen consisted of the collapsed cyst wall, plus a hard firm piece of tissue. After the resection of the left tube and ovary, there was noted a similar cyst existing in the right ovary about the size of a large indoor ball. However, at the base of this cyst, there was felt a hard concrete-like mass. This cyst was similarly deflated with the aspirating trocar. The right tube and ovary were now resected without any difficulty. On sectioning the hard concrete-like mass, at the base of the ovary, it was thought that the structure was a fibroma of the ovary which was coexistent with a serous cystadenoma. The abdominal cavity was found to be free from any bleeding points. Continuous chromic No. 1 catgut was employed to close the peritoneum and transversalis fascia. Continuous chromic No. 1 catgut was employed for anterior rectus sheath, and plain 00 interrupted sutures for subcutaneous fat. A continuous interlocking medium dermal suture was employed for the skin. The patient left the operating table in excellent condition.

Pathologic Examination.—The sediment from the centrifuged specimen of fluid consisted of a small amount of material which would occupy the volume of a sphere of 1 mm. in diameter. This material was grayish-white in appearance. It disclosed foam cells, polymorphonuclear leucocytes, and cholesterol clefts.

Gross Examination.—The left ovary measured 26 by 19 by 10 centimeters. It contained a cyst 20 by 15 by 7 cm., which was filled with clear straw-colored fluid and which was lined by a smooth, grayish-white membrane. A papillary projection 0.2 cm. in height projected into the lumen of the cyst. In the ovarian tissue at one pole of the cyst was a mass which measured 3.5 by 3 by 0.4 centimeters. This tissue was firm and the cut surface showed grayish-white interlacing bundles of tissue. Several small cysts were present, ranging in size from 0.2 to 1.4 centimeters.

The right ovary measured 10 by 7 centimeters. It contained a cyst measuring 5 cm. in diameter lined by a smooth grayish-white membrane and filled with clear straw-colored fluid. In the ovarian tissue outside the cyst was a firm mass of tissue measuring 5 by 3 by 2 centimeters. The cut surface of this tissue was grayish-white and showed interlacing bundles of tissue.

A section of Fallopian tube 6 cm. in length showed no important changes except for an occluded fimbriated end.

Microscopic Examination.—The cyst from the left ovary was lined by a ciliated low columnar epithelium with small papillary projections into the lumen of the cyst. The cyst in the right ovary was lined by ciliated columnar epithelium. No papillations were present.

The solid tumors consisted of spindle-shaped cells with single nuclei. These cells were closely packed together except for an occasional area where a large amount of intercellular substance was present. The cells in some areas were arranged in parallel rows, whereas in others a mosaic pattern was produced. Mitotic figures were very rare, and blood vessels were not numerous. Frozen sections of these tumors stained with sudan III showed no fat.

The tumors occurring in this case, namely fibroma and serous cystadenoma, are not rare. The fibroma of the ovary may be considered an unusual but not

infrequent tumor and has been recognized as the most common connective tissue tumor of the ovary. Barzilai credits it with representing 1.7 per cent to 5 per cent of all ovarian tumors. However, benign solid tumors of the ovary are much less frequent than benign cystic neoplasm. Boyd states that serous cyst adenomas form 33⅓ per cent of cystic tumors of the ovary. Thus, this case pre-

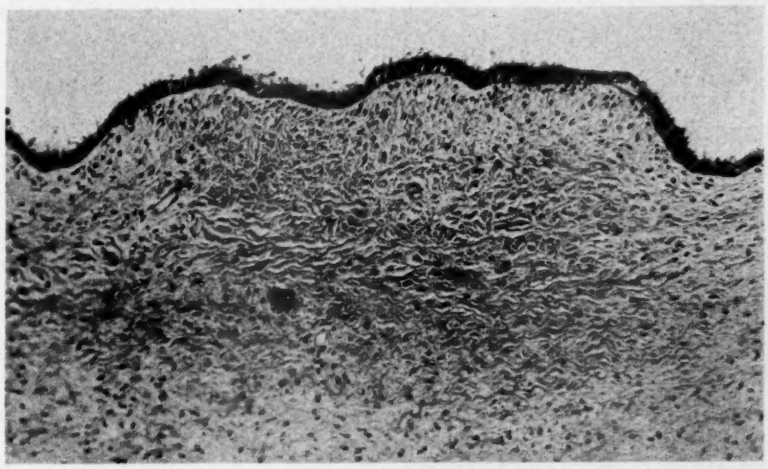

Fig. 1.—Ciliated columnar epithelial lining of cyst from right ovary (×100).

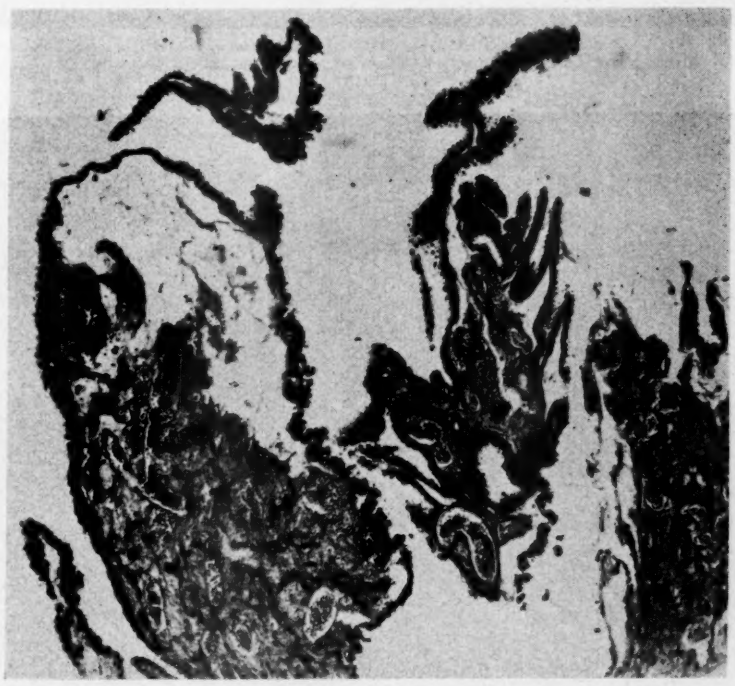

Fig. 2.—Papillation in cyst from left ovary (×80).

sents a combination of the most common benign solid ovarian tumor and the most common benign cystic tumor of the ovary, yet this combination is most unusual. The age of the patient, 70 years, is not of particular significance, for ovarian neoplasm can occur at any age. Downes found an ovarian tumor in a 7-month-old infant, and Spencer reported ten ovarian tumors in women over 80 years of age.

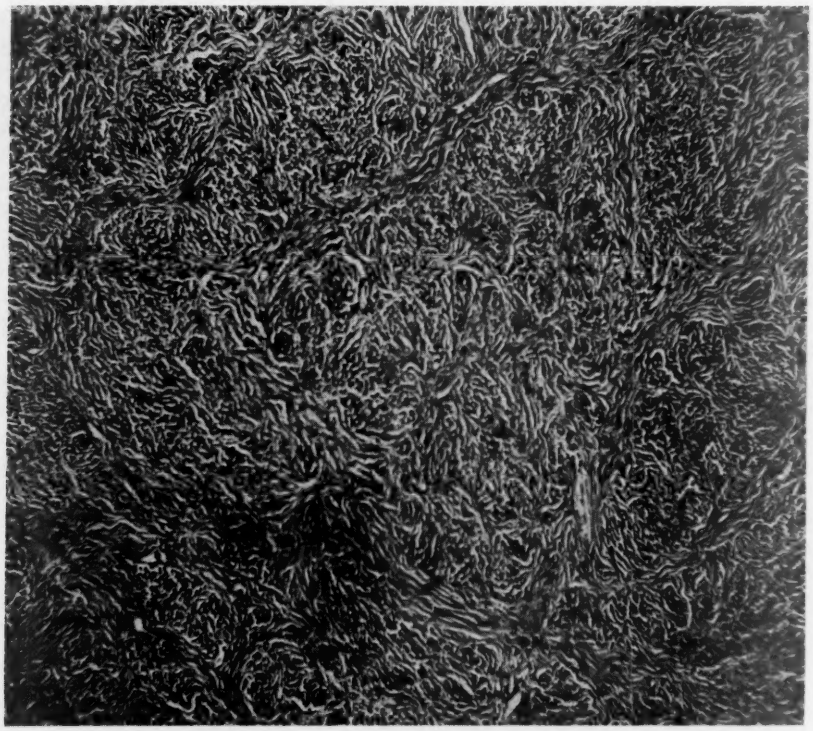

Fig. 3.—Mosaic pattern of spindle cells of fibroma from left ovary (×100).

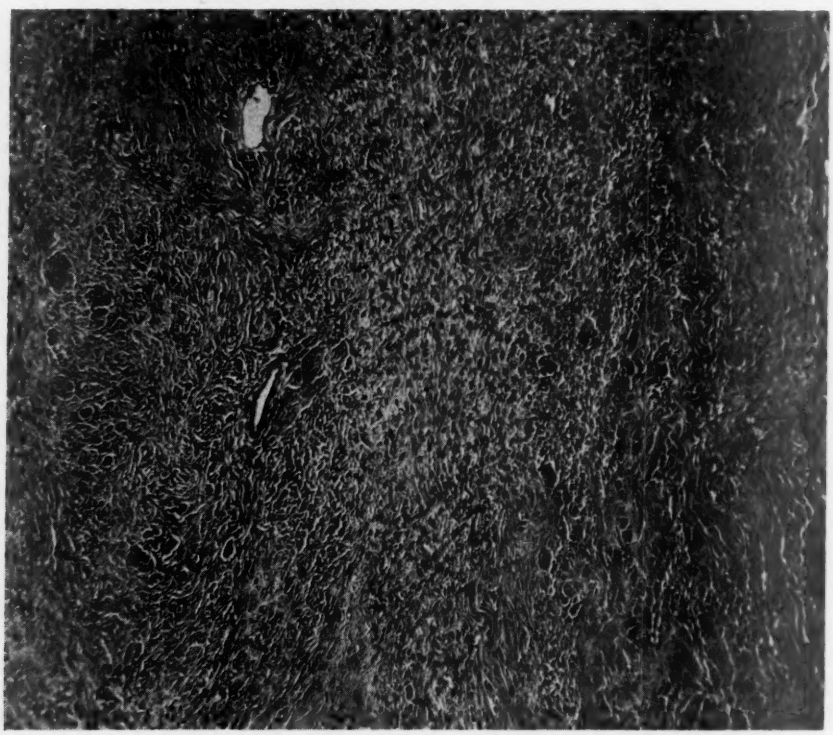

Fig. 4.—Spindle cells in parallel rows from fibroma of right ovary (×100).

The incidence of the coexistence of multiple ovarian tumors has given rise to a maze of conflicting and confusing statistical studies. The best explanation of this fact is Ewing's statement: "Statistical studies of multiple tumors have included in one category so many events of widely different significance that no general conclusions of any value can be drawn from them. The validity of assuming the existence of a general predisposition to cancer based on such statistical studies may be doubted."

This particular case represents an incidence of multi-centric growth of varying tumors in the same organ. It is possible that the term "multi-centric" is erroneous, but according to the present-day knowledge of the histogenesis of the ovarian fibroma and ovarian cystadenoma, such usage of the term multi-centric appears to be proper.

The fibroma of the ovary is considered to be of stromatogenous origin, but its definite histogenesis is not clear. Transitions from fibromas to adenofibromas have been described by Orthmann, Schottlaender, and others. Fibromas are often bilateral, as have been noted by Pfannenstiel, Kroemer, Geist, and others. Such was the instance in the present case: Figs. 3 and 4 show the typical dense bundles of spindle cells in mosaic and parallel arrangements; they do not show any evidence of mitoses or irregularity of the cells, so there is no difficulty in eliminating a malignant type of growth.

The bilateral papillary cystadenomas were unilocular, the left being unusually large, and the right being of usual size. The cyst from the left ovary was lined by a ciliated low columnar epithelium with small papillary projections into the lumen of the cyst. The cyst in the right ovary was lined by ciliated columnar epithelium, but no papillations were present. Although serous cystadenomas are frequently bilateral, they are not usually seen in a woman of 70 years. There was no evidence of malignant changes in either cyst. Geist states that papillary cystadenomas are frequently associated with other types of ovarian neoplasm, which may occur in the same ovary, but are more often in the opposite one. He states that associated fibromas have been reported.

There is no question that the serous cystadenoma originates from the germinal epithelium of the ovary. Novak states: "The chief evidence for this statement is that possible gradations can be demonstrated from simple invagination . . . to the fully formed papillary cystadenoma." The germinal epithelium varies greatly in its invasive qualities, as is demonstrated by the fibroadenoma of the ovary. However, this type of growth is not to be confused with the growth reported in this paper.

A cystadenoma, as well as a fibroma, may originate in a Brenner tumor. Meyer showed that the connective tissue response may assume huge proportions in some of these cases, so that tumors weighing several pounds may result. In the case under discussion there does not appear to be any resemblance to a Brenner tumor.

Summary

1. A case of bilateral ovarian fibroma and serous cystadenoma is reported.

2. Although this combination of ovarian growths has been previously reported, according to Geist, the incidence is extremely rare.

3. This combination of growths represents the most frequent benign solid ovarian tumor and the most frequent benign cystic ovarian tumor.

4. Both growths assumed large proportions and occurred in an elderly female long after the menopause.

5. A similar combination of growths is sometimes associated with a Brenner tumor.

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1415 Delachaise Street

ACUTE SUPPURATIVE PAROTITIS COMPLICATING PREGNANCY AT TERM

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PAROTITIS as a complication of pregnancy is infrequent, and the acute suppurative variety is very rarely described in the literature. In approximately the last forty-five years, both the *Quarterly Cumulative Index to Current Medical Literature* and the *Index Medicus* have listed only three articles[3, 6, 8] dealing with this complication in pregnancy. Two of these are in foreign journals,[3, 8] and the third is a parotitis following an induced abortion.[6] One of the two articles published abroad[8] deals with a heterogenous collection of different forms of parotitis (i.e., epidemic, suppurative, and parotitis relative to carious teeth) in eight cases of pregnancy.

Since this complication is described so infrequently in the literature in relation to pregnancy, we are reporting the case of M. B., who was delivered on the Obstetrical Service of Queens General Hospital on Aug. 29, 1945. In a survey of the statistics of this institution, we find that from Nov. 1, 1935, to Nov. 1, 1945, there were 14,517 deliveries. There was one other case of acute parotitis complicating pregnancy reported in this interval, and this latter case, on review, is apparently the epidemic variety of parotitis. So that, over a period of ten years in this institution, there was only one case of acute suppurative parotitis in pregnancy. It has been stressed that the prognosis is grave. The following is a report of a complete and uneventful recovery in such a case.

M. B. (A-79520), a 27-year-old, white, married, primigravida, a housewife, was admitted Aug. 26, 1945. Past history was irrelevant, except that she had mumps three years before admission. Antepartum course was essentially uncomplicated. Last menstrual period was Nov. 15, 1944; expected date of confinement, Aug. 22, 1945. The blood Wassermann done in the antepartum clinic on May 31, 1945, was negative. Labor pains had begun at 6:00 P.M. on Aug. 25. On admission, "pains" were coming about every fifteen minutes. Bag of waters was intact.

Examination on admission revealed a moderately well-developed and well-nourished, white woman weighing about 120 pounds and in no distress.

The tonsillar fossae were both slightly injected. The nostrils were negative. Facies was normal and symmetrical. Blood pressure was 135/80. The fundus was 2½ cm. below the xiphoid process. Fetus was estimated to be about 7 pounds. Position of fetus was believed to be right occipitoposterior. Fetal heart was 148 beats per minute in the right lower quadrant.

On rectal examination, the cervix was 2 cm. dilated and thick. The head was three fingers above the spines.

The temperature was normal. Urinalysis on August 26 was negative. Hemoglobin at this time was ten grams. Kline test on August 29 was negative. Patient was blood type O and Rh positive.

The uterine contractions were of desultory type on August 26. On August 27, the contractions were recorded as occurring every five minutes, but the head was still unengaged. After forty-three hours of such progress, x-ray pelvimetry was done, and showed a moderate-sized asymmetrical pelvic inlet with the pos-

terior segment anthropoid and the anterior segment gynecoid. The ischial spines were prominent. Position of the fetus was right occiput transverse.

The patient developed a "running nose" on August 28. Examination showed a coryza with hyperemia of both tonsillar regions. Pain was present over the angle of the left jaw. A firm swelling occupied the pre- and infra-auricular area on the left, of about 3 by 5 centimeters. This had a definitely hard border outlining the area of the parotid gland. On this day labor was still described as poor, but the fetal heart was still good, being 128 beats per minute. Intravenous fluids were given continuously to supplement the oral intake which was small.

Consultants from the Contagion Service of this hospital diagnosed this complication as an acute left suppurative parotitis. A purulent, white discharge was expressed from the orifice of the left Stenson's duct, and a pouting of the orifice was seen.

X-ray of the jaw at this time revealed no calcified shadows in the region of the left Stenson's duct, or in the left parotid region. The temperature on August 28 was never above normal. On this day, a white blood count in the forenoon revealed 7,640 cells with 68 per cent polymorphonuclear leucocytes, 12 per cent transitional cells, and 20 per cent lymphocytes. A repeated blood count that evening revealed 9,500 white cells, with 84 per cent polymorphonuclear leucocytes, and 16 per cent lymphocytes. A catheterized urine specimen on the preceeding day (August 27) was negative.

On the recommendation of the consultants, the patient was started on 2 Gm. of sulfadiazine at once, and 1 Gm. every four hours thereafter, with double the amount of soda bicarbonate for each dose. Irrigations of the mouth with a normal saline solution, and warm applications to the outside of the left jaw were also used. The sulfadiazine was continued for about forty-eight hours.

An attempt was made on August 28 to stimulate uterine contractions, which were described as poor in quality. A soapsuds enema, immediately followed by 60 c.c. of castor oil was given, and in one hour the soapsuds enema was repeated. Six grains of quinine hydrochloride were also given. Since the patient made little more progress, in the evening she was also given ¼ grain of morphine sulphate which gave her about five hours of sleep. After she awoke, the pains were very strong. One and three-fourths hours of such pains brought her up to full dilatation. With a low forceps, an 8-pound male infant was delivered after eighty-seven and one-half hours of labor.

On the day of delivery, August 29, her temperature was 101.0° F., and the parotitis was unchanged. The mass on the jaw began to decrease in size within about twenty-four hours after delivery. Blood count done on August 31 showed that her white blood count was 10,000, with 70 per cent polymorphonuclear leucocytes, 5 per cent transitional forms, and 15 per cent lymphocytes. On the first day post partum, her temperature was 99.8° F. Mother and baby were discharged on the ninth day post partum in good condition. No vestige of the parotitis was present on discharge.

Comment

The relationship of the parotid gland to systemic disorders has never been satisfactorily explained. It has long been known that parotitis occasionally occurs as a grave complication in infectious fevers. Paget[6] in 1886 pointed out that parotid bubo might appear secondarily, as a rare complication following operations and injuries to pelvic and abdominal organs. About 101 cases were collected by him from both the literature and his expefience. Parotitis of all kinds following septic abortion and puerperal infection, on the other hand, has been described by several observers.[6, 8]

It appears, from the reports of cases of postsurgical and obstetric parotitis, that the etiology of acute suppurative parotitis might be found in two sources,[6] local or general. The first source of infection probably enters the gland via Stenson's duct. From a review of other cases of parotid gland involvement, it is apparent that the oral cavity has a very important part in the formation of parotid bubo. A large number of different organisms are known to inhabit the mouth, and under normal circumstances they are harmless. The patient's local resistance may be lowered, or the oral tissues may be traumatized, as from too vigorous swabbing of the mouth, or by the drying effect of an anesthetic, or by blood loss, or the depletion of body water, either from limited fluid intake or vomiting. Under such circumstances, otherwise innocuous bacteria might be conceived as invading the parotid through the duct of Stenson. There might also be a direct extension of infection from any area adjacent to the gland, as the ears or teeth.

The second source is believed to be a metastatic process, in which bacteria are conveyed to the parotid from another more distantly located organ, by the blood or lymph. Anatomically considering this explanation, it is to be noted that the parotid is the only one of the three salivary glands which contains lymph nodes. A slowing of the blood or lymphatic streams at the parotid, especially if the resistance of the patient is lowered by a debilitating condition, may produce a sufficient number of organisms to overcome the resistance of this tissue.

The most commonly found offending organism in acute suppurative parotitis is *Staphylococcus aureus hemolyticus.* This organism is one of the inhabitants of the nasopharynx. *Streptococcus viridans* is the second most important cause, but in contrast to the *Staph. aureus,* which causes the acute parotitis, the *Strep. viridans* produces the recurrent form of parotitis. *Pneumococci,* the third most commonly found organism, may cause either type of disease. *Odium albicans* and *Bacillus coli* are some of the bacteria which are less frequently found.

Treatment.—Prophylactic therapy is the best. Good hygiene, especially oral hygiene, and more attention to the fluid intake of the patients should be carefully observed. In those cases where no fluctuation has taken place, conservative therapy is used. This consists of hot boric acid applications, irradiation, irrigations of the mouth, and sulfonamides. It is felt that [2, 4, 5, 7, 9] in severe cases, incision and drainage should be done as early as possible. It is not wise to wait until frank fluctuation occurs before doing an incision and drainage, as necrosis and gangrene may appear before the fluctuation can be noted through the dense parotid fascia.[9]

Indebtedness for assistance is due to Dr. E. A. Fleming, Dr. Alexander Gross, and Dr. Arthur A. Goldfarb.

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1475 Grand Concourse

ENTEROUTERINE FISTULA

With a Review of the Literature and Report of an Unusual Case

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THE reported occurrence of fistulous openings between the bowel and the uterus is very uncommon. In 1933 Danforth and Case collected 58 cases appearing in the literature for the past two hundred years. Since then an additional 20 cases have been reported. All of these 20 do not appear with full information, so that complete statistical summarization is not possible. Some are only mentioned in articles and are apparently cited from personal communications, or they are referred to in the discussion of the paper. Terechoff, in reporting a case, mentions seven additional cases which he knew to exist without including the full data on them.

Method of Production.—Le Jemtel in 1909 predicated three causes. The first is either traumatic or spontaneous rupture of the gravid uterus with a loop of intestine entering the tear; the bowel is pinched with subsequent necrosis and fistula formation. Peritonitis with abscess formation is a second cause, when the abscess ruptures into the bowel and the uterus simultaneously. The third cause, carcinoma, usually of the body of the uterus, occurs when the malignant tissue undergoes ulceration and necrosis with the development of a fistula between it and any loop of large or small bowel which becomes adherent. More recent reports mention a fourth cause: as the result of faulty technique during uterine curettement. The fistula results from the puncture of the uterine wall with concomitant injury of the bowel. Of the total cases, 42 followed obstetric injuries, 16 were the result of inflammatory processes, 9 were caused by carcinoma, and 11 followed uterine curettement.

Some fistulas developed from unusual pathology. Dwyer reported a woman with spontaneous rupture of the uterus at six months' gestation with a fistula between it and the small intestine due to pressure of the fetal cranial bones. The fetus was finally extracted thirteen months after the onset of pregnancy. Schmid reported a fistula between the uterus and the large and small intestine caused by sigmoidal cancer. This was the only instance of the nine mentioned in which the carcinoma did not originate in the body of the uterus. Naremoff, as quoted by Terechoff, treated a case caused by ulcerative colitis of the large bowel.

Location of the Fistula.—In many of the reports the location of the bowel opening was not mentioned, while in some the exact site of the communication could not be determined. Of those allowing analysis, in eighteen the fistulous tract was between the small intestine and the uterus, and in seventeen between the large bowel and the uterus. In three instances both large and small bowel had communications with the uterus. Neugebauer reported two cases of fistula between the stomach and the uterus.

Treatment.—Crossen and Crossen state: "intestinouterine fistula is so rare that generalization is not possible." They feel that whether the fistulous tract is connected with the uterus, vagina, or bladder, it is best handled by abdominal section with mobilization and separate closure of the bowel wall. They also believe that in cases of small fecal leakage plenty of time should be given for scar tissue contraction to close the fistula spontaneously before subjecting the patient to the hazards of operation.

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Graves, in his textbook, states that complicated fistulous tracts beween the viscera are sometimes created through the medium of pus tubes or infected ovarian cysts. No instances, however, of a communication produced in this manner were found. The following case history is an example of a fistula resulting from this cause.

Case Report

A 22-year-old white woman, a member of the WASP, became ill in November, 1944, experiencing severe abdominal pains, especially in the left lower quadrant. They were accompanied by moderate fever and malaise. Several weeks later, while at home on leave, she consulted a local physician who stated that she had a pelvic mass on the left side which should be operated upon. She did not accept his advice but returned to her duty station. A few days later she began to pass feces through the vagina. Since this occurred she had had no bowel movements through the rectum. She felt feverish, with the pain in the lower abdomen continuing. The menstrual periods had been regular; the last period occurred on November 15. She did not believe she was pregnant; she denied all suggestions of instrumentation.

Past history revealed an uncomplicated appendectomy in 1938. She had been married four years, and had had one child in 1941. The delivery was normal; no instruments were used. There had been no other pregnancies. For the past six or eight months she had noticed mild intermittent pain in the lower abdomen. The pain came in brief attacks, lasting several hours, especially after exercise. She also complained of mild chronic constipation.

On reporting to the hospital, a diagnosis of enterouterine fistula was made, and she was transferred to this hospital. Physical examination showed that she was acutely ill with marked dehydration and a high fever. With a speculum in the vagina a hemopurulent discharge was seen exuding from the cervix. A mass was felt in the left fornix contiguous with the uterus. The presence of a fistulous tract between the bowel and the uterus was proved by instilling water into the rectum and observing it as it returned through the cervix. The communication was thought to be high, inasmuch as four to six ounces of water had to be instilled in the rectum before any return flow occurred. No barium or other radiopaque substance was injected to delineate the tract because the patient was acutely ill. For several days whole blood, intravenous fluids, and nutritional supplements were administered; the mass was then drained through a left lower quadrant muscle-splitting incision. Four to five ounces of foul pus were obtained, which was found to be *Streptococcus viridans* of the coli-aerogenes group.

Postoperatively the patient had several attack of nausea with recurrent vomiting and abdominal distention necessitating tube suction drainage. Her temperature remained fairly normal, with several intermittent spiking elevations. Bowel movements through the rectum were resumed two weeks after drainage of the abscess. There was not complete drainage of the abscess, however, as evidenced by occasional temperature elevations and palpable enlargement of the left-sided mass. The incision was explored several times under pentothal anesthesia to re-establish drainage.

Therapy for the next several months consisted of frequent transfusions, vitamin supplements, and a high caloric diet. During this time the patient improved tremendously. Fecal drainage from the cervix continued, as well as passage of stools from the rectum. Because the fistula did not heal spontaneously, a Devine transverse colostomy was performed. Another reason was to defunctionalize the bowel prior to repair of the existing fistula. Exploration during this operation revealed that no exact delineation of the pelvic organs could be determined, except that the uterus was pulled to the left and adherent

to a mass which involved the rectosigmoid. As would be expected, there was no further discharge through the cervix or from the rectum, but the abscess drainage wound continued to drain fecal pus in small amounts intermittently. The patient was ambulatory. She gained fifteen pounds in weight.

Laparotomy was then performed to repair the fistulous tract. On exploration the uterus was found drawn to the left and adherent to the left adnexal mass. The only structures easily recognizable were a piece of omentum and a loop of ileum three feet from the ileocecal valve which was adherent. Continuing into what was the sigmoid colon. The extent and size of the other pelvic organs could not be immediately determined. The mass which measured about 10 cm. in diameter was attached to the abdominal wall in the area of the previous drainage. The omentum and the small bowel, which was adherent in two places forming a U-shaped loop, were separated. Thickening of the proximal ileum indicated the presence of chronic partial intestinal obstruction. After separation of the ileum several small areas of denuded serosa were inverted. The right tube and ovary which were thickened and chronically inflamed could next be identified deep in the pelvis. The body of the uterus was separated from the mass. The sigmoid colon proximal and distal to the area of involvement was identified. In dissecting the sigmoid free, the fistulous opening between it and the adnexal mass was found. At this point the diameter of the sigmoid was constricted to a caliber of one-eighth normal size. Final separation of the tuboovarian mass from all surrounding structures was accomplished by freeing it from the anterior abdominal wall. It was removed after cutting the tube at its uterine attachment and ligating the infundibulopelvic ligament. The left broad ligament and the drainage hole in the abdominal wall were peritonealized. The cicatrized portion of the sigmoid colon was excised and an end-to-end anastomosis performed.

At operation it was impossible to be sure whether the sigmoidouterine fistula occurred because of inflammation arising in the left tube or ovary, or because of some inflammatory reaction originating in the sigmoid. The sigmoid was so involved in the infectious mass that its lumen had been almost completely obliterated where it was adherent. No diverticuli were seen in the rest of the descending colon and none was reported in the specimen submitted to the laboratory. Pathologic report of tissue removed showed chronic suppurative salpingitis and abscess formation of the left ovary. Section of the specimen revealed the appearance of ovary with scattered and numerous infected cysts. Microscopic sections of the largest cyst showed a scant amount of fiorinopurulent content. The thick lining consisted of granulation tissue densely infiltrated with lymphocytes, polymorphonuclear leucocytes, and plasma cells.

The patient made an uneventful recovery. The area from which the tuboovarian mass had been removed drained purulent material for about ten days through the old left lower quadrant drainage wound. A barium enema three weeks post operative showed colonic continuity well re-established, with only slight narrowing of the bowel lumen. The spur of the transverse colostomy was therefore crushed with a Devine colostomy clamp. The bowel mucosa was subsequently dissected free from the skin and inverted to allow closure of the skin.

Comment

Repeated attempts by different medical officers were made to obtain a history of instrumentation, but to no avail. The etiology was important not only from pathologic interest, but also in determining procedures to be instituted in producing a cure. It is believed that this patient had a chronic salpingitis with a cystic ovary on the left side. The ovarian cyst became inflamed with the

formation of an abscess which ruptured into the cavity of the uterus and into the bowel. The point of rupture into the cavity of the uterus must have been through the lumen of the tube, inasmuch as no other communication with the body of the uterus could be demonstrated.

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ABDOMINAL WALL FIBROMA (URACHAL?) SIMULATING OVARIAN CYSTOMA

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THE case described below is of interest from at least two aspects: (1) the confusion in preoperative diagnosis, and (2) the comparative rarity of the neoplasm in question. While there would seem to be no doubt that the removed tumor was a degenerating fibroma, we cannot, of course, be certain of its urachal origin because the mass had grown to a size which seriously distorted the normal anatomy of its site. Fibromas and fibromyomas of this region have been reported as urachal tumors by Begg (1931), and the normal anatomy of the urachus and its associated fasciae has been described recently by Hammond, Yglesias, and Davis. An extensive survey of neoplasms of the anterior abdominal wall by Pack and Ehrlich in 1944 (Memorial Hospital, New York) indicated that 55 per cent of tumefactions of all kinds in that area were benign tumors, and that 9 per cent of the latter were fibromas. No mention is made, however, of the possible urachal origin of any of the fibromas.

Case Report

A. N., Hospital No. 4176, a 50-year-old white woman, was admitted on Feb. 15, 1945, with complaints of lower abdominal pain and vaginal bleeding. The last menstrual bleeding had begun on July 3, 1944. Having had fifteen previous pregnancies, the patient assumed in August that she was again pregnant. In October she believed she felt fetal movements, and these continued up to the time of hospitalization. In November she experienced five days of intermittent vaginal bleeding and was treated by a private physician for "threatened abortion." The same physician followed her as a prenatal patient until the onset of bleeding on the day of admission, and then referred her to the hospital with a presumptive diagnosis of "placenta previa." The vaginal bleeding was not excessive, but it was accompanied by cramplike abdominal pains at intervals of twenty minutes, and these the patient interpreted as "labor."

Physical examination revealed a 98-pound woman with blood pressure of 160/104, systolic murmur at the apex of the heart, moderate generalized distention of the abdomen, and a tympanitic percussion note over the upper half. No fetal heart sounds were audible. Extending 12 cm. above the symphysis pubis was a semisolid, somewhat mobile mass which seemed to contract when palpated. There was a small amount of old blood in the vagina and there was further blood exuding from the external cervical os. The cervix was hypertrophied and exhibited cervicitis and erosion. Anterior and superior to the cervix there was a mobile cystic mass, estimated to be 14 cm. in diameter, and a uterus of normal size lay posterior to the cystic mass. A probe was inserted into the uterine cavity to a depth of 3 inches. The adnexal areas and rectum were normal to palpation. The immediate diagnostic impression was: pedunculated ovarian cystoma, no evidence of pregnancy.

Further study showed normal urine, hemoglobin 12 Gm. per 100 c.c., leucocyte count 9,500 per cu. mm., normal thoracic roentgenogram, and normal

cystogram. X-ray examination of the abdomen showed no evidence of pregnancy nor any calcification within the tumor mass.

On the third hospital day exploratory laparotomy, under spinal anesthesia, revealed an extraperitoneal tumor lying just anterior to the parietal peritoneum and immediately superior to the apex of the urinary bladder. The irregular semi-solid mass measured 15 by 14 by 12 cm. and was quite easily shelled out intact, although it had a fibrous pedicle superiorly which ran toward the umbilicus, but gradually lost its identity in the surrounding connective tissue (see Fig. 1). There was no direct connection between the surface of the tumor and the wall of the bladder. Because of the patient's age and the uncertainty as to the cause of her uterine bleeding, total hysterectomy and bilateral salpingo-oophorectomy were performed prior to closing the abdominal wall. The subsequent course was uneventful and the patient left the hospital on the eleventh postoperative day. She was examined eight months after the operation and there was no evidence of recurrence of the tumor.

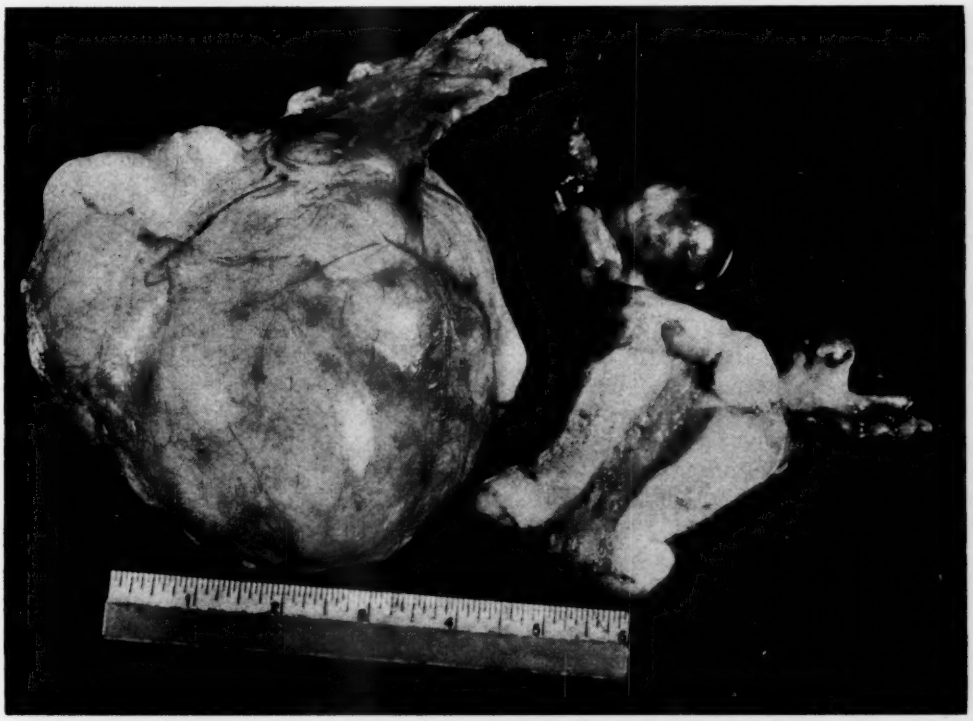

Fig. 1.—At left, the fibroma; at right, uterus (opened anteriorly) with attached tubes and ovaries.

The gross specimen was an encapsulated mass measuring 15 cm. in greatest diameter, irregularly rounded with secondary projections from its surface. Sections through the mass disclosed large areas of whitish semi-solid gelatinous tumor and multiple cystic spaces, two of the latter being quite large (4 by 5 cm.). The cavities contained odorless, yellow, slightly mucoid fluid which coagulated upon standing. Uterus, tubes, and ovaries were grossly normal aside from the enlarged cervix and a small physiologic cyst in each ovary. Multiple microscopic sections through the tumor showed masses of well-differentiated connective tissue cells, large areas of edema and some hyalinization. The endometrium showed changes characteristic of the second or third

day of menstruation; there were cystic follicles in the ovaries, and the cervix showed chronic cervicitis with erosion.

Conclusion.—Degenerating fibroma of the anterior abdominal wall, essentially normal uterus (menstruating), and multiple ovarian follicular cysts.

Summary

A lower abdominal mass in a 50-year-old woman, para xv, was first mistaken for a pregnant uterus, later assumed to be an ovarian cystoma, and finally at operation demonstrated to be a degenerating fibroma of the anterior abdominal wall.

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PRIMARY LIPOMA OF UTERUS

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BECAUSE this condition is extremely rare, and because it simulated a degenerating fibroid or a possible associated intrauterine pregnancy, we felt this case worthy of report.

In 1899 Brüning published for the first time a case of intramural lipoma of the uterus. Walkoff, in 1901, described in the German literature a case of sarcomatous degeneration of a uterine lipoma. In a review of the literature, D. P. Hall[1] quotes Ellis of London and Gault of Vienna, who analyzed 7,000 uterine neoplasms and found only four cases; two were fibrolipomas and two were small lipomas. F. B. Lund,[2] in his report, states that "they occur almost always in women over 60 years of age."

However, our own case report deals with a woman who was only 39 years of age.

Ritter and Stringer[3] reported a case of lipoma of the uterus in a patient 55 years of age.

A. J. Peterson,[4] in his review of mixed tumors of the uterus, lists a number of fatty tumors of the uterus which appeared in world literature ranging from the years 1816 to 1921, and only twenty-six lipomas are recorded.

The exact origin and pathogenesis of the uterine lipoma remains a moot problem. The rarity of the lipomas in the uterine wall may be ascribed to the lack of fatty cells in the muscle wall. Knox of Harvard, according to Ritter and Stringer, believes that the lipomas originate from embryonic cell rests, while Brüning believes that they are the transformation of the muscle fiber into fat. Others think that the fat cells around the blood vessels of the uterine wall may be the source of the lipoma. A. J. Peterson, whose histopathologic report scrutinizes every tumor carefully and fully, believes that grossly a tumor may appear like a lipoma, but that microscopic sections may reveal other tissue mixed with the predominating tissue.

Case Report

B. O. (4518072), a 39-year-old Negro woman, gravida i, para i, was admitted to the Cook County Hospital with a history of a progressively enlarging abdominal tumor. She also complained of menorrhagia.

Physical examination revealed a woman who was not acutely ill. Her blood pressure was 150/90; temperature, 98.6° F.; pulse, 80.

The essential findings were those of a large abdominal mass the size of an eight months' pregnancy. It was firm and fixed.

Pelvic examination revealed no gross external genital abnormalities. The cervix was wedged against the symphysis pubis. The abdominal mass also filled the entire pelvis. Some areas of the mass felt quite soft, resembling a degenerating fibroid or a concomitant pregnancy.

A diagnosis of uterine fibromyoma was made preoperatively.

Laboratory Data.—The urine was negative; hemoglobin, 80 per cent; red blood count, 4,100,000; white blood count, 6,350. X-ray plate showed no fetal parts or other shadows.

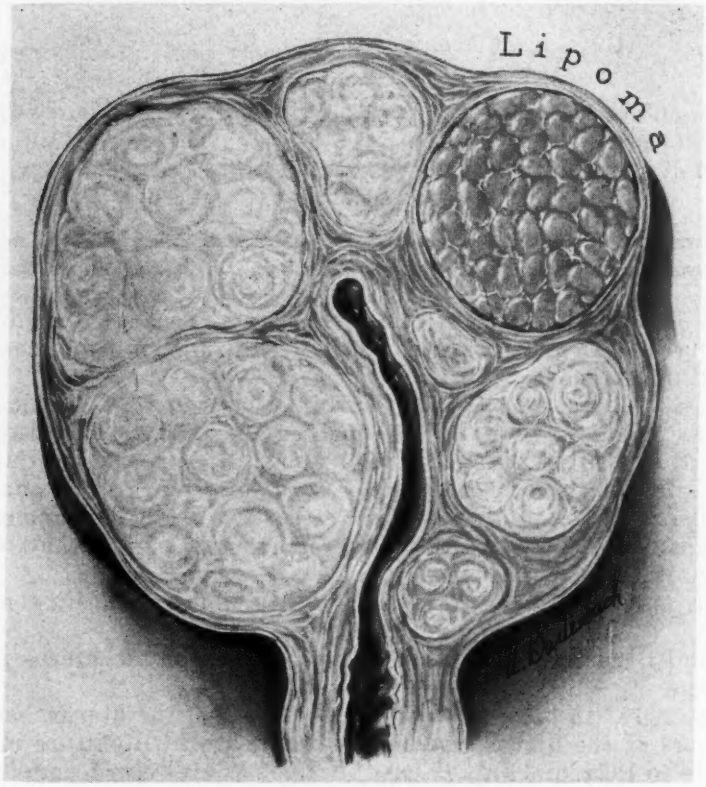

Fig. 1.—Cross section of uterus showing site of lipoma.

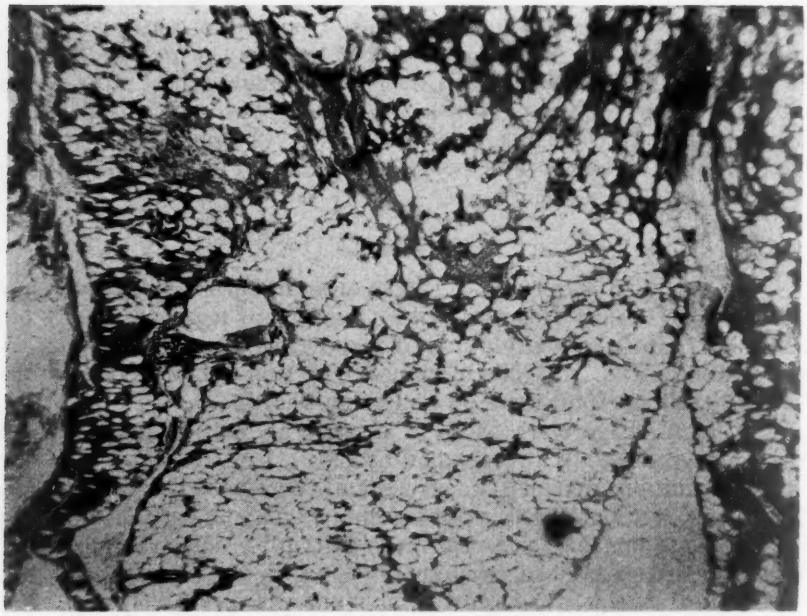

Fig. 2.—Photomicrograph of section of lipoma (×25).

On May 5, 1945, three days after the admission to the hospital, she was operated upon. When the peritoneal cavity was entered, a large multinodular fibroid uterus was noted. However, one of these large nodes felt very soft on gross palpation. A supracervical hysterectomy and bilateral salpingo-oophorectomy was done. The patient made an uneventful recovery and left the hospital twelve days later.

Pathological Report.—Multiple uterine fibromyomas. One intramural encapsulated large lemon-sized node on cut surface appeared yellow and soft. Microscopic section revealed uniform areas of encapsulated fat; no mixture of muscle fibers.

Diagnosis.—Lipoma of uterus.

Summary

In a review of the literature it appears that during the last twenty-five years only four cases of uterine lipoma are recorded. Review of literature by A. J. Peterson revealed only 26 lipomas on record from 1816 to 1921.

Although the lipoma, as such, is of no great importance, it is interesting from the didactic and histopathologic picture; and, clinically, its softness resembles a degeneration of a fibroid or a possible associated pregnancy.

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ABDOMINAL PREGNANCY WITH PLACENTA ATTACHED TO THE SPLEEN*

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ABDOMINAL pregnancy at term is no longer a clinical rarity. Cornell and Lash reviewed the literature in 1933 and found that the maternal mortality was 14.3 per cent and the total infant mortality was 67.3 per cent. Only 35 per cent were diagnosed correctly before operation.

A review of the literature reveals no case in which the placenta was attached to the spleen in its entirety and it is for this reason that this case is being reported.

Mrs. S. G., a 35-year-old white married woman was referred to one of us (D. H. K.) on Sept. 6, 1944. Her last menstrual period began on June 6, 1944, and her estimated date of confinement was March 13, 1945. This was her third pregnancy. Both previous pregnancies were terminated by normal deliveries, in 1932 and 1935. Menstruation started at the age of thirteen, lasted five days, occurred regularly every twenty-eight days, and was painless.

She presented the following history: There was a bloody discharge for a two- or three-hour period three weeks after her last period in June. During July and August she "felt faint" most of the time, but more so toward evening. There was usually a feeling of pressure on the bladder and pain in the lower abdomen which was relieved by enemas.

About the middle of July she felt a severe pain in the left side, which spread over the entire abdomen, to the back, chest, and shoulders. She was unable to urinate or defecate, and laxatives had no effect. Enemas could not be taken because "the water refused to go in beyond a certain place." She had to be catheterized and this decreased the pain.

She was in bed for two weeks with the above complaints, taking codeine and "other drugs" daily. Urination and defecation were painful with tenesmus. She fainted frequently, especially when the bladder became full.

The backache was present all the time, more so on the left side. She had the sensation "as though the urine did not flow freely from the left kidney." There was also a constant ache in the left lower extremity, as well as occasional spotting.

Physical examination revealed no abnormalities except a mass in the right adnexal region. The uterus was enlarged to the size of a three months' pregnancy. Pelvic measurements were within normal limits.

Laboratory Findings.—Friedman test was positive and her blood was Rh positive. Wassermann test and urinalysis were negative. Basal metabolic rate was plus 2 per cent; hemoglobin, 65 per cent; red blood cells, 3,340,000; white blood cells, 9,950, with 63 per cent polymorphonuclear leucocytes, 32 per cent lymphocytes, and 5 per cent eosinophiles.

Weight on the first visit was 130 pounds, and during the first three months she gained 8 pounds, but this gain was lost during the last six weeks. Blood pressure ranged between 112/70 and 120/80. On two occasions she fainted in the office, but was able to go home alone. The fetal heart was heard until Feb. 12, 1945. X-ray on Feb. 14, 1945, revealed the following:

*Presented at a meeting of the Washington Gynecological Society, November 24, 1945.

Roentgen Findings.—Examination of the abdomen in the anteroposterior, oblique, and lateral positions revealed a fetus of about eight months' gestation in the left occipitoanterior position. The entire fetus did not give a normal tone; it was doubled upon itself somewhat, although the head did not present the Spaulding sign. Nevertheless, it was our belief that the fetus was nonviable.

The patient was admitted to Columbia Hospital on April 9, 1945, for a laparotomy on April 10, 1945. Under avertin and ethylene anesthesia, a midline suprapubic incision was made. Upon entering the peritoneal cavity, thin, dark, chocolate colored fluid and old blood escaped. A macerated fetus was extracted. The placenta was attached in its entirety to the spleen which was enlarged about four times its normal size and extended about six centimeters below the left costal margin. The placenta was removed very easily. The wall of the pregnancy was anterior to and covered all of the pelvic and abdominal viscera except for the spleen.

Pathologic Report.—The body was that of a badly macerated fetus without genitals, 15½ inches in length. The legs were badly deformed and extremely short, measuring only 3¼ inches in length. The feet were of normal length but very flat. The anus was not perforated. All the abdominal structures were in a thin-walled membranous sac approximately 4 by 4 inches without apparent skin. The cord was 6¾ inches long, and there was apparently no umbilicus. The placenta was 6¼ by 4 by 2 inches.

The patient made an uneventful recovery, being discharged on the eleventh postoperative day. The highest temperature was 102° F. the night of the operation.

The first postoperative visit was on May 11, 1945, at which time the patient weighed 115 pounds, her temperature was 101° F. and a hard mass could be felt 2 cm. above the umbilicus. On pelvic examination, this mass was apparently attached to the uterus. The spleen was only slightly enlarged. On June 1, 1945, the mass was smaller and the temperature was 99.4°. On July 2, 1945, the mass was the size of a grapefruit. The patient was afebrile. On September 11, 1945, the mass was of the same size, patient had no fever, she weighed 120½ pounds and was able to go back to work. Menses had returned normally.

Summary

A case of abdominal pregnancy with the placenta attached in its entirety to the spleen is reported. The fetus was abnormal and macerated. The mother made an uneventful recovery.

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INFREQUENCY OF CARCINOMA OF THE UTERINE CERVIX AMONG JEWISH WOMEN

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THAT carcinoma of the uterine cervix occurs with striking infrequency in Jewish women has been brought forth previously in several statistical studies and reports.[1-5]

In a recent analysis of 568 consecutive cases of carcinoma of the cervix encountered at the Mayo Clinic in the years 1938 to 1942, inclusive, and in which the diagnosis was proved at biopsy, it was found in 566 instances that the expressed religious preference of the patient was specifically given as other than Jewish. The religious preference was taken to be equivalent to what sometimes is designated as race. In not a single instance was the religious preference stated as being Jewish. There were two instances in which it was impossible to classify the patient definitely as Jewish or non-Jewish since the religious preference was given by the patient as "none, or no preference."

In a small number of the 566 cases, in which it would have been otherwise impossible to be sure, it was by the cooperation of the referring physician that it became definitely possible to classify the patient as non-Jewish; in the two doubtful instances mentioned, the referring physician was unable to help in definitely determining whether the patient was Jewish or non-Jewish. However, it can be definitely stated that in neither instance did it appear at all likely from the other available data that either of these two patients was Jewish. The impressive fact stands out that even if the two patients had been proved to have been Jewish, still the low incidence of Jewish women among patients with carcinoma of the uterine cervix would have been strikingly corroborated by this study. The estimated Jewish registration by per cent of total at the Clinic is approximately 7 to 8 per cent; the per cent of Jewish persons in the total population of the United States, as given in the World Almanac for 1945, is about 4 per cent.

It is quite possible that one or more Jewish women of Christian religion have been encountered in this series without our knowing that they were Jewish, since it is estimated that about 4 per cent of the Jewish population, or 200,000, are Christians.

On the basis of the 7 per cent mentioned in a preceding paragraph, one would have expected to find approximately forty Jewish women in our series; actually, as has been shown, there were no women in the group who were known to be Jewish and only two instances in which the religious and racial status of the patient was in doubt.

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MULTIPLE PREGNANCY WITH EARLY ABORTION OF ONE FETUS

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DE LEE[1] mentions that in dichorionic or double-ovum twins, one fetus may die and be expelled, with the other going normally to term.

On Nov. 30, 1944, one of us (E. M. B.) was called to attend a young primipara who had undergone an abortion. By an examination of the products of conception, an embryo measuring approximately 6 cm. was identified. Vaginal examinations four weeks and again seven weeks later revealed a persistent enlargement of the uterus, first about the size of an orange, and later about the size of a grapefruit.

Nine weeks after the abortion occurred it was possible to identify positively fetal heart sounds and to recognize an enlargement of the uterus to about that of a four and one-half months' pregnancy. The case continued through a normal pregnancy to delivery on June 27, 1945, of a normal, full-term 7-pound male infant.

Apparently this is an instance of a multiple dichorionic pregnancy, in which one embryo was lost by abortion while the other progressed normally to term. Hirst[2] points out that many multiple pregnancy miscarriages occur but are overlooked.

In an analysis of 573 cases of twin pregnancy by Guttmacher[3] on the Johns Hopkins Hospital Service, no reference to such an occurrence is made. Similarly, Hirst's study of 305 twin pregnancies omits the details on any similar instance. If, however, the dead fetus is retained instead of being expelled early in pregnancy, the familiar fetus papyraceus results, and this is more frequently the subject of case reports.

Closer observation and more detailed histories on obstetric patients would lead to a more frequent recognition of early miscarriages in multiple pregnancies. DeLee mentions a specific case: "The senior author delivered a woman at term of twins, and she stated that five months previously she had had an abortion of four months." No doubt in the memories of many practitioners such an occasional history can be recalled. Case reports, however, are not numerous in medical literature.

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WINGED STEM PESSARY TO CORRECT STENOSIS OF CERVIX

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STENOSIS of the external os uteri is occasionally met in sterility cases. This usually is the result of previous cauterization, but sometimes appears congenital. A probe will not pass the stenosis and, because of faulty drainage, the secretions become changed to the point that sperm will not progress through the canal.

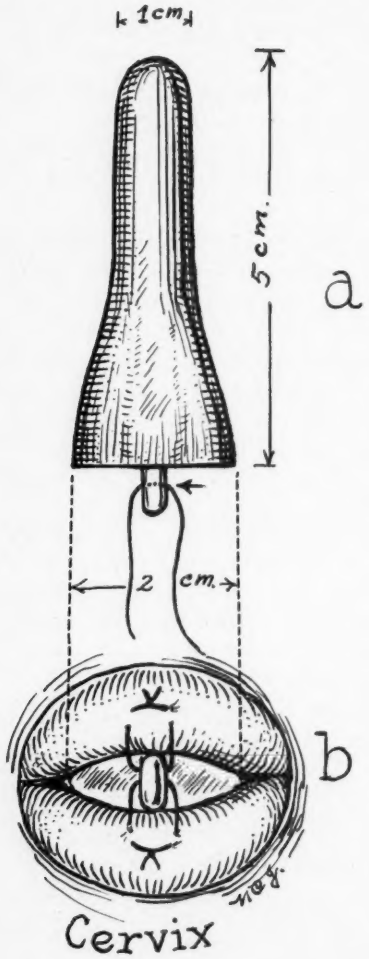

Fig. 1.

Various surgical procedures have been employed to overcome this difficulty, the simplest being posterior discission and the glass stem pessary. The cutting operation leaves a mutilated cervix, and the failures of the stem pessary gave me the idea of placing a wing on opposite sides of the cervical end of the stem.

This winged pessary is placed in the cervix after an incision is made in the cervical canal on both sides from the internal os in a slanting, outward direction to the lateral edge of the external os. Usually, it is wise to dilate the canal first. When inserted, the wings of the pessary fit into the bilateral cuts, separating the surfaces so that the epithelium grows in over the raw edges. Healing takes place in about two weeks, leaving a funnel-shaped opening which looks like a bilateral first-degree tear. The pessary should be anchored to both the anterior and posterior lips with a mattress suture of silkworm gut.

This winged stem pessary has been used only in highly selected sterility cases on whom all other tests have been normal except the Hühner test. While only twelve patients have been so treated in the last six years, eight have become pregnant.

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Pregnancy: Physiology, Diagnosis, Etc.

Lund, Curtis J.: Nutrition in Pregnancy, J. A. M. A. 128: 344, 1945.

The author reviews the essential dietary needs during pregnancy. He feels that for optimal supply the daily diet should consist of one generous serving of meat including liver weekly, one quart of milk, an ounce of butter, one fresh vegetable, one green leafy vegetable, and one other cooked vegetable, generous amounts of citrus fruits or their equivalent, an egg, and whole grain cereal or enriched bread. The average pregnant woman requires about 2,500 calories per day during pregnancy. For purposes of weight reduction, the diet may be limited to 2,000 calories or less, and minerals and vitamins may be supplemented. The diet should be ample in protein. There is no need for supplements in calcium if the patient gets one and one-half grams of native calcium daily. A daily intake of 15 mg. of iron will produce a positive balance in most cases, and in cases of iron deficiency 15 grains of ferrous iron daily will suffice. Most iron deficiency anemias occur in the last trimester of pregnancy. Plasma levels of vitamin A tend to decrease during pregnancy. Adequate amounts of the B complex can be supplied by diet alone. It is not necessary to give additional amounts of vitamins C and E during pregnancy. Complications of pregnancy probably exert a greater influence on nutrition than does nutrition on them. Such conditions as hyperemesis gravidarum, pyelitis of pregnancy, puerperal infection, and other acute and chronic infections may produce nutritional deficiencies.

WILLIAM BERMAN.

Odell, Lt. Lester D., and Mengert, Wm. F.: The Overweight Obstetric Patient, J. A. M. A. 128: 78, 1945.

The authors found 641 cases of obese women (weighing 200 pounds or more at or before birth of a potentially viable baby). The incidence of obese women was 3.85 per cent, and the incidence of deliveries among obese women was 4.57 per cent. Fourteen sets of twins were encountered, which is somewhat higher than the normal incidence of twinning. Toxemia of pregnancy was noted in 31.4 per cent of the cases, and the next most frequent finding was glycosuria. These women tend to be relatively young and fertile. No unusual presentation was noted in these women. Prolonged labor (30 or more hours) occurred in 5 per cent of the cases. Postpartum hemorrhage was noted in 7.1 per cent of the cases. The operative incidence is approximately twice the usual clinical incidence. Approximately 57 per cent of the infants weighed more than 3,500 grams at birth. Thirty-five of the infants died (4.5 per cent). Forty-three per cent of the fetal deaths occurred in utero. Puerperal complications, chiefly sepsis, occurred in 12.6 per cent of the cases. There were four maternal deaths (0.53 per cent). It was noted that with repeated pregnancies the incidence of hypertensive disease, fetal death, breech, and occiput posterior presentation increased.

WILLIAM BERMAN.

Perez, Manuel Luis: Diagnosis of Anencephaly During Pregnancy, An. d. Inst. matern. y asist. social, Buenos Aires **5**: 86, 1943.

The author insists that a clinical diagnosis of anencephaly may be arrived at on the basis of the following facts: difficulty in locating the cephalic pole in the small pelvis, when no other factors exist to account for it; identification of the pelvic pole at the opposite end and provocation of fetal movements, even convulsions, by compression of the zone which logically should be occupied by the lower pole. Roentgenography will confirm the suspected anomaly.

J. P. GREENHILL.

Pregnancy: Complications, Etc.

Polayes, S. H.: Erythroblastosis Fetalis in Mothers With Rh Positive Blood (Report of 6 Cases With Comment on Isoimmunization With the A and B Agglutinogens), Am. J. Dis. Child. **69**: 99, 1945.

The author reports two cases which fulfill all the clinical critera for the diagnosis of erythroblastosis fetalis (icterus gravis neonatorum).

In both cases the mother's blood group was group O, Rh positive and the child's group A, Rh positive. The Rh factor and all its known variants, as well as the Hr antigen, were excluded as possible immunizing antigens. Although more statistical data are required to establish the frequency of such cases, nevertheless it is believed that (a) isoimmunization by the A and B agglutinogens may occur, and that (b) erythroblastosis fetalis may result from A or B isoimmunization by a mechanism similar to that already established for the Rh factor.

JAMES P. MARR.

Gregg, N. McAllister: Rubella During Pregnancy of the Mother With Its Sequelae of Congenital Defects in the Child, M. J. Australia **1**: 313, 1945.

The author reviews the historical development of the sequelae of rubella with relation to congenital defects of the newborn. These consist chiefly of congenital defects of the eyes, ears, teeth, and heart. This disease is important from the standpoint of public health. The author urges everyone to consider this complication of pregnancy as serious and urges study of the disease with an attempt to isolate the virus and develop both a prophylactic and a curative treatment. It is felt that careful and detailed evaluation and investigation of the maternal history throughout pregnancy may unravel some of the unsolved problems with reference to congenital defects.

WILLIAM BERMAN.

Fox, M. J., and Sennet, L.: Poliomyelitis in Pregnancy, Am. J. Med. Sci. **209**: 382, 1945.

Case histories of four pregnant women who developed anterior poliomyelitis are presented. From a review of the literature, the conclusion is reached that pregnancy increases the susceptibility to poliomyelitis. Of the cases reported in adult women 31.3 per cent were pregnant. The increased susceptibility may possibly be due to the change in the ovarian secretion, although pituitary dysfunction as well as fetal hormones may also be factors.

In the four cases reported, the delivery of two normal children and the examination of a fetus in a dead mother confirmed the opinion that poliomyelitis in the mother does not affect the newborn child, nor does it hamper normal spontaneous delivery. Possible studies on the endocrinologic approach to the poliomyelitis problem are suggested.

FRANK SPIELMAN.

Badia, P. D.: Instrumental Rupture of a Five Months' Pregnant Uterus, Am. J. Surg. **66**: 97, 1944.

Early diagnosis and immediate surgical intervention is recognized as being of paramount importance in the management of the ruptured pregnant uterus. In presenting this case report, the author in retrospect analyzes the factors which resulted in the fatal out-

come, and points out what may have been done to avoid it. The patient was a 27-year-old Negro nullipara who, according to her story, had had a sudden bloody vaginal discharge and severe lower abdominal pain following a two-month interval of amenorrhea. On admission to the hospital, a diagnosis of twisted ovarian cyst and pelvic inflammatory disease was made. Operation was performed on the eighth day following admission at which time there was marked abdominal distention and a rising temperature. A five months' fetus was found in the peritoneal cavity surrounded by its amniotic sac which had been extruded through a longitudinal rent in the posterior wall of the uterus. The abdomen also contained a large quantity of liquid blood and many clots. The edges of the uterine laceration were necrotic, partially organized, and showed adhesions to ilium and omentum. In view of these findings, a rapid supravaginal hysterectomy was performed, but the patient went into deep shock and expired forty minutes following the conclusion of the operation.

It is obvious that interference in order to induce abortion had occurred, which accounted for the laceration of the uterus, and that the patient's persistent denial did much to confuse the picture. However, in the author's opinion, the diagnosis should have been made and operation performed much earlier. The importance of combating shock is also stressed.

FRANK SPIELMAN.

Puerperium

Vignes, H.: Postpartum Phlegmasia Without Fever or Permanent Tachycardia, Rev. de path. Comparée. **553**: 38, 1940.

The author reports the case of a primipara who had an uneventful pregnancy except for varicose veins and a mild albuminuria. She had a quick, easy labor, and the puerperium was entirely afebrile. However, on the tenth day, the calf of the left leg was painful, tender to the touch, swollen, and violet in color. There was pain at the bend of the groin and along the crural vein. During the following few days the edema increased considerably. In spite of these findings, both the temperature and pulse remained normal. The attack of phlebitis lasted twelve days and the symptoms disappeared after two months.

This case emphasizes what the author has previously maintained that even normal easy labor may be followed by phlebitis. Therefore, the discussion should be reopened as to whether or not phlebitis always has a microbic origin, as maintained by many obstetricians. The author believes that the case he reports most likely did not have an infectious basis.

J. P. GREENHILL.

Trivelli, O., and Garcia, P.: Pelvic Puerperal Suppuration Spontaneously Opened Into the Rectum, Bol. Soc. chilena de obst. y ginec. **9**: 161, 1944.

The authors have observed ten such cases in slightly over one year. Their occurrence must be higher than commonly supposed and their diagnosis is seldom made because the physician does not think of them.

The pathognomonic sign is sudden evacuation of a large amount of pus with the feces; this is nearly always followed by termination in crisis of the signs of suppuration. This "rectal emesis" is preceded by a characteristic symptomatolgy which must be correctly interpreted. It consists of diarrhea, rectal tenesmus, pain in the perineum, bladder symptoms without urinary infection, together with the classical symptoms of suppuration.

There were two postpartum and eight postabortion cases.

The various types of pelvic suppuration may give rise to the accident such as phlegmon of the broad ligament, tubo-ovarian abscess, suppurative parametritis and adnexitis, pelvic cellulitis, etc.

Evacuation of the pus through the rectum occurred from six to eleven months after delivery or abortion. The evolution was most rapid in the two postpartum cases.

All cases healed well and subsequent, repeated proctoscopy could not demonstrate a fistulous opening. In most cases there was a complete return to normal; in the others there persisted a residual process characterized by induration on palpation and a higher sedimentation rate, but without subjective manifestations worthy of consideration.

When opening into the rectum becomes imminent, in the presence of a grave toxic picture with evident danger, it may be advisable to help evacuation through the rectum with the object of eliminating as soon as possible the cause of the toxemia which may kill the patient. If spontaneous evacuation is incomplete, proctoscopy to locate the orifice, enlarge it, and obtain better drainage may be advisable.

J. P. GREENHILL.

Thompson, J. W., and Le Blanc, L. J.: Congenital Diaphragmatic Hernia, Am. J. Surg. 67: 123, 1945.

Following spontaneous delivery of a normal infant, the patient, whose case is here reported, a gravida ii, suddenly experienced severe epigastric pain five hours after parturition, and showed signs of marked distress referred to the chest. In addition to the usual supportive measures instituted, bedside x-ray revealed the stomach displaced into the left thorax. A diagnosis of left diaphragmatic hernia with strangulation was made and, because of the continued alarming condition of the patient, laparotomy was decided upon. At operation most of the hollow abdominal viscera were found to have migrated into the left chest through a large opening in the diaphragm. The mesenteries of the stomach and intestine were elongated, and there was counterclockwise rotation of the viscera causing torsion of the pancreas which was acutely inflamed and covered with a fibrinoplastic exudate with numerous areas of fat necrosis. The only organs remaining in the abdomen were the spleen, the liver, and the descending colon. The viscera were easily replaced, the margins of the hernial ring freshened with scissors, and approximated and overlapped with one layer of chromic catgut and another of heavy black silk. With the aid of parenteral glucose-saline and small transfusions, the patient made a good recovery.

The literature is reviewed, and the authors, besides calling attention to the possibility of this condition which often remains undiagnosed, stress the importance of immediate surgical intervention as in any strangulated hernia. Where the diagnosis is made early in pregnancy, they favor immediate repair because of the grave danger of strangulation during the latter months or as a complication of delivery or of the puerperium.

FRANK SPIELMAN.

Trillat, P., and Notter, A.: Bacteriologic Study of Pyelonephritis Associated With the Puerperal State, Gynéc. et obst. 40: 491, 1939.

The authors observed 60 cases of pyelonephritis, 37 of which began during pregnancy, and 23 began post partum. In 27 cases the colon bacillus was isolated; in 3 cases, staphylococci; and in 2 cases, the Friedländer bacillus; all in pure culture. In the remaining 28 cases there were mixed groups of bacteria. In 67 per cent of these 28 cases the colon bacillus was associated with the enterococcus. In others streptococci, staphylococci, and pseudodiphtheria were present. Among the 60 cases there were 13 cases of albuminuria. There were no maternal deaths in this series and only one fetal death. There were four premature babies in the entire group. The cases with pure strains of bacteria were less serious than those with associated organism. All the patients were treated with autovaccinotherapy and in no case was ureteral catheterization necessary.

J. P. GREENHILL.

Keymer, Eduardo: Two Cases of Grave Puerperal Infection Treated With Penicillin, Bol. Soc. chilena de obst. y ginec. 9: 287, 1944.

The author states that his first case, which he regards as one of chronic pyemia, presented two episodes of fourteen days each, which were treated with 66 and 57 Gm. of sulfadiazine, respectively. These episodes were separated by three days of relative im-

provement during which plasma therapy with sulfathiazole was administered every other day. After the second episode, there was again a remission of symptoms for one day, followed by another aggravation which lasted only five days and coincided with the administration of 275,000 units of penicillin, at the rate of 25,000 units daily. Then came a period of improvement for nine days, interrupted by the appearance of a pulmonary abscess with its septic picture which improved as soon as the collection of pus emptied into a bronchus.

The insufficient dosage of penicillin and the fact that the only organism found in cultures of the lochia was *Escherichia coli hemolytica*, which is penicillin-resistant, would suggest slight or no action of the drug in this case. But the failure of sulfonamide therapy, blood transfusions, and sulfonamide plasma therapy during the first two episodes, and the occurrence of improvement as soon as penicillin was used militate in favor of a beneficial action of the drug. Besides, the presence of *Escherichia coli* in the lochia does not mean that the general infection of the patient was caused by this germ.

The second case was supposed to be a thrombophlebitis of the upper pedicle: apparently it improved with the first course of penicillin, because the septic picture returned on suspension of the drug and definitely improved with the second course which was followed by sulfadiazine therapy. Altogether, 710,000 units of penicillin were given intramuscularly. During the second course, four blood transfusions were also given to combat coexisting anemia and as adjuvant treatment.

J. P. GREENHILL.

Vaginal Infections

Sako, Wallace, Tillbury, Ross, and Colley, Jesse: One-Dose Penicillin Treatment of Chronic Gonorrheal Vaginitis in Children, J. A. M. A. **128**: 508, 1945.

The authors report 16 cases of chronic gonorrheal vaginitis treated by the one-dose method. In all clear-cut cases the diagnosis was established by smear, and in other cases the diagnosis was made by smear and culture. After all previous medication had been discontinued for one week, the patient was given 100,000 units of penicillin dissolved in 20 c.c. of isotonic sodium chloride solution. This was injected intramuscularly. In some cases 3 minims of adrenalin were added to prolong the effect. A cure was effected in 15 of the 16 cases treated. No toxic symptoms were noted and hospitalization was not necessary.

WILLIAM BERMAN.

Carceller, Mariano Vicente: Trial of Sulfonamide Therapy in a Case of Vulvar Condylomatosis, Rev. españ. de obst. y ginec. **1**: 183, 1944.

The author prescribed tentatively a para-amido-phenyl-sulfamide ointment for local application to the cleansed lesions. After one week he observed marked improvement: some of the vegetations of the upper and central portions of the principal seat of the lesions had disappeared completely and others were evidently regressing. After two weeks of treatment, only a few condylomas were left in the region of the fourchette and these were smaller and definitely improved. Cure was undoubtedly completed with continuation of the treatment, but this could not be demonstrated because the patient did not return.

J. P. GREENHILL.

Schauffler, Goodrich C., and Schauffler, Caroline: Current Concepts of Vaginitis and Vulvar Irritations in Infants and Children, West. J. Surg. **53**: 35, 1945.

Irritation of the vulva in children may be the result of simple neglect, long contact with urine or feces, allergic tendencies, trichomonas and monilia infection, trauma secondary to masturbation, diabetic dermatitis, and pin worms. Actual infections of the vulva in children is rare. Practically all infections of the vulva were secondary to infections of the vagina, and approximately 60 to 70 per cent of the infection in the vagina is caused

by the gonococcus. The low estrogen concentration in the immature female results in a thin vaginal membrane, and its Ph is such as to encourage the bacterial growth. The cervix does not harbor infection. It may be the site of erosions due to extrusion of the delicate, single-layered, endocervical mucosa. No treatment is indicated.

Vaginitis and secondary vulvitis in children is satisfactorily treated by the local use of estrogen suppositories and sulfathiazole. The vulva is washed with a cleansing solution, and if local administration is difficult, the sulfonamides may be given by mouth. Resistant gonococcal infection can be treated by the use of penicillin.

Foreign bodies in the vagina produce an acute vaginitis, but the discharge is usually blood-tinged. Exploration with a sound will elicit contact sensations which aid in the diagnosis.

WILLIAM BICKERS.

Venereal Diseases

Gray, Laman A.: The Treatment of Acute Gonococcal Pelvic Inflammatory Disease in the Female With Penicillin, South. M. J. **38:** 405, 1945.

The author reports on the treatment of thirteen women with gonococcal pelvic inflammatory disease after treatment with penicillin. Each case had been diagnosed by culture on chocolate agar plates. Each patient received 25,000 units of penicillin intramuscularly every three hours for forty-eight hours, a total dose of 400,000 units. Patients were allowed out of bed. No ice bags or douches were given. All patients were bacteriologically cured as shown by smears and cultures. The symptoms of acute salpingitis and peritonitis began to improve forty-eight hours after the penicillin was begun. The cervical discharge changed from the purulent type to a mucoid discharge in three days. The tuboovarian masses and pelvic induration frequently progressed after the patient was apparently cured from a bacteriologic standpoint. Residual pelvic induration was found in all thirteen cases, in spite of the fact that they were bacteriologically cured.

WILLIAM BICKERS.

Day, Lois A.: Chancroid of the Cervix: Report of Two Cases, Proc. Staff Meet. Mayo Clin. **20:** 70, 1945.

Prior to the war, chancroid was very rarely encountered except in seaport cities and in communities with a large Negro population. Since the war began, the author thinks it well to be on the lookout for chancroid infection, particularly of the cervix, and for the purpose of calling attention to some of the clinical manifestations of chancroid in the female, reports two such cases seen in the Mayo Clinic. The diagnosis is made by excluding syphilis, gonorrhea, the presence of the *Hemophilus ducreyi* in smears, and a negative Frei test. Chemotherapy: sulfathiazole very promptly cleared up the first case; but, in the second, the patient could not take the sulfonamide and penicillin was given with marked success.

HARVEY B. MATTHEWS.

Malignancies

Rojas, Daniel A.: Cancer of Cervix and Pregnancy, Bol. Soc. de obst. y ginec. de Buenos Aires **23:** 471, 1944.

The author reports six cases from which he draws the following conclusions:

Cancer of the cervix is an infrequent complication of pregnancy. Five of the patients were between 30 and 35 years of age, and multiparas. The diagnosis of cancer was made during labor and in the ninth, seventh, and fourth months of pregnancy in one case each, and in the third month in two cases.

In four cases the pregnancy went to term; in two of them the fetus was delivered through the natural route and in the other two by cesarean section, which was followed by total hysterectomy. In two cases of pregnancy in the third month, the Wertheim or Latzko

hysterectomy was easily performed. In one of the cases of natural delivery at term, Wertheim's operation was performed eight weeks later, and in the other, vaginal hysterectomy was done four months after delivery.

At the time of operation, all cases were within the limits of operability, and there was no operative mortality. Three patients were not heard from after the operation. Of the other three, one died after fourteen months and one after eight months, both from metastasis to the pelvis; the third is alive and well for over six years.

J. P. GREENHILL.

Albertelli, Jorge F.: Cancer of Cervix and Pregnancy, Bol. Soc. de obst. y ginec. de Buenos Aires **23**: 217, 1944.

The author presents the rules followed at the Maternity Institute in the treatment of these cases.

Operable cancer. In a pregnancy over six months, abdominal cesarean section is performed and followed immediately by total hysterectomy. When the viability of the fetus cannot be established with certainty, expectation of not over three weeks may be adopted to increase the chances of fetal survival.

In a pregnancy under six months, total hysterectomy of the intact uterus is performed. In a pregnancy of from five to six months, application of radium (40 m.c.d.) may be used to allow waiting for growth of the fetus until it is viable.

During labor, abdominal cesarean section is performed, followed by total hysterectomy.

In inoperable cancer, in a pregnancy over six months, abdominal cesarean section followed immediately by Porro hysterectomy or simple subtotal hysterectomy is performed. Subsequently, intracavitary radium therapy and transcutaneous roentgen therapy are used. In borderline cases of fetal viability, an application of radium is given as mentioned for operable cancer.

In a pregnancy under six months, respect for fetal life must increase as the probabilities of ultimate cure of the mother decrease. Radium application (50 m.c.d.) is recommended. Early pregnancy will probably be interrupted; if not, interruption may be considered after cicatrization of the cervical lesions. If the pregnancy is close to six months, viability of the fetus will be awaited and the same conduct is then adopted as in pregnancy over six months. Once the uterus is evacuated, the treatment is completed with transcutaneous pelvic roentgen therapy.

During labor, the treatment is cesarean section followed by Porro hysterectomy and then physiotherapy.

The corrected operative mortality of Albertelli's series is 0 per cent, the death of one patient being due to an anesthetic accident.

J. P. GREENHILL.

Correspondence

Pyridoxine in Nausea and Vomiting of Pregnancy

To the Editor:

In his article (AM. J. OBST. & GYNEC. **51:** 82, 1946) Dr. Hesseltine says that "pyridoxine in the dosages and methods used is of no more value in the treatment of mild or moderate nausea and vomiting of pregnancy than scores of other preparations." He also states that the use of pyridoxine in the "treatment of hyperemesis gravidarum is valueless and without justification." This last statement was made with the observation of one patient who did not respond to treatment as used by Dr. Hesseltine. We believe our answer to his conclusions given is that the pyridoxine was incorrectly administered.

His article casts doubt on the results obtained and reported by us on the use of pyridoxine in nausea and vomiting of pregnancy.[1] We should like to clarify the points upon which we disagree.

Dr. Hesseltine pointed out, quite rightly, that a plethora of products had been used, the virtues of many of them extolled, and the subsequent failures left unreported. We do not wish to retract, in any way, any of the statements made by us concerning the use of pyridoxine hydrochloride, as used by us, in the treatment of nausea and vomiting of pregnancy.

He stated that it was impressive that a number of patients with symptoms sufficient to require treatment could be collected in a short period of time. Since one-third of all pregnant women have nausea and vomiting to a marked degree, the number of patients is not difficult to explain. Our original article contained a report on the results of treatment of forty patients. From September, 1943, when our original report was made, through September, 1945, we gave prenatal care to and delivered eight hundred thirty private patients. Two hundred of these patients had symptoms producing discomfort or illness sufficient to require treatment. All of these patients fell into one of the four classifications suggested by Weinstein and his associates.[2] Three patients in this group were sufficiently ill to require hospitalization and, in addition to pyridoxine hydrochloride, the usual methods of treatment were employed. All recovered and were delivered at term. In the entire group there were three other patients who were not relieved by the use of pyridoxine hydrochloride.

Our objection to Dr. Hesseltine's conclusions are based on the fact that he condemned the treatment but did not follow the same procedure as used by us. We did not put patients on a schedule of treatment. We stated in our original article that we found oral therapy to be of no value. We did not give pyridoxine hydrochloride intramuscularly. All of our injections were given intravenously, the dosage being 25 to 50 mg., and repeated as often as the symptoms recurred.

We have found pyridoxine hydrochloride, given intravenously, a very highly satisfactory agent to be used in the treatment of nausea and vomiting of pregnancy. If at any time we find it necessary to reverse our opinion, we shall so inform the interested members of the medical profession.

WYNNE M. SILBERNAGEL, M.D.
OLAN P. BURT, M.D.

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References

1. Silbernagel, W. M., and Burt, O. P.: Ohio State M. J. 39: 1113, 1943.
2. Weinstein, B. B., Mitchell, G. J., and Sustendal, G. F.: AM. J. OBST. & GYNEC. 46: 283, 1943.

Reply by Dr. Hesseltine

To the Editor:

I appreciate the views of Dr. Silbernagel and Dr. Burt, and support their right to clarify their views. I question not their results, but the mode of action which gave these results. We did not use the intravenous method as advised by Silbernagel and Burt, for we do not know of any pharmacological proof that the intravenous route is distinctly superior to the intramuscular route.

Our primary concern was for proof, not contention. We extend the request for compilation of facts and adequate controls in all scientific studies.

H. CLOSE HESSELTINE, M.D.

CHICAGO LYING-IN HOSPITAL

The Guterman Pregnancy Test

To the Editor:

The May, 1946, issue of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY (Vol. 51, pp. 685-691) includes a paper by A. G. Morrow and R. S. Benua entitled, "An Evaluation of the Guterman Pregnancy Test." These authors set out to test the validity of the color method of pregnanediol determination as a diagnostic test for pregnancy in a study of 19 patients. The original procedure was reported in two papers (*J. Clin. Endocrinol.* 4: 262-267, 1944; 5: 407-411, 1945), the conclusions being based upon an examination of 248 cases. The details of the method and its basis are given in extenso there. This work has been completely confirmed in 304 cases by G. McCormack (AM. J. OBST. & GYNEC. 51: 722-725, 1946), who followed the technique closely.

I should like here to point out the reasons which I think led to the contradictory results reported by Morrow and Benua in their small series.

1. The "slight modifications for convenience" are neither slight nor are they convenient for clinical laboratory use. These modifications include vacuum distillation over a steam bath instead of evaporation on the hot plate, the use of 1 ml. of a 10 per cent solution of sodium in 95 per cent ethanol instead of 20 ml. of a two per cent solution of sodium hydroxide in absolute methanol, and the use of No. 42 Whatman paper instead of fritted glass filters.

2. The authors adapted the qualitative color test to a Klett colorimeter employing a filter transmitting between 500 to 570 mμ. At 500 mμ pregnanediol in concentrated sulfuric acid shows little color absorption. The maximal color absorption is between 420 to 430 mμ as reported by N. B. Talbot and co-workers (J. Clin. Endocrinol. 1: 668-673, 1941) and this laboratory (1944). That Morrow and Benua were not measuring pregnanediol alone is borne out by their inconsistent quantitative colorimeter readings upon the addition of pure pregnanediol to male urine. In this laboratory, the addition of pure pregnanediol to male urine leads to reproducible colorimeter readings (Klett-Summerson colorimeter, 420 mμ filter and Cenco-Sheard spectrophotelometer, 430 mμ band) when the procedure is followed closely.

Since the method was not followed in important details, and since the colorimeter assay was done at a wave length which may include substances other than pregnanediol, the paper is strictly speaking not an evaluation of the test as published from this laboratory.

HENRY S. GUTERMAN, M.D.

DEPARTMENT OF METABOLIC
AND ENDOCRINE RESEARCH
MICHAEL REESE HOSPITAL
CHICAGO, ILL.
MAY 21, 1946

Item

American Board of Obstetrics and Gynecology, Inc.

Candidates certified at the annual meeting of the American Board of Obstetrics and Gynecology, May 5 to 11, 1946:

ADKINS, T. F., K-I-A University Apts., Durham, North Carolina
ANNITTO, J. E., 170 Belmont Ave., Jersey City, New Jersey
ARNOLD, ANN W., 1218 Medical Arts Bldg., Minneapolis, Minnesota
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ROSTER OF AMERICAN OBSTETRICAL AND GYNECOLOGICAL SOCIETIES*

(Appears in January, April, July, October)

American Gynecological Society. (1876) *President,* Norris Vaux, Philadelphia, Pa. *Secretary,* Norman Miller, Ann Arbor, Mich. Annual meeting to be announced.

American Association of Obstetricians, Gynecologists and Abdominal Surgeons. (1888) *President,* Lewis F. Smead, Toledo, Ohio. *Secretary,* James R. Bloss, 418-11th Street, Huntington, W. Va., Annual meeting Hot Springs, Va., Sept., 1946.

Central Association of Obstetricians and Gynecologists. (1929) *President,* John H. Moore, Grand Forks, N. D. *Secretary-Treasurer,* W. F. Mengert, Dallas, Tex. Annual meeting Chicago, Ill., Sept. 19-21, 1946.

South Atlantic Association of Obstetricians and Gynecologists. (1938) *President,* Robert A. Ross, Durham, S. C. *Secretary,* T. J. Williams, University, Va. Annual meeting on steamer, Tampa to Havana, Feb. 7-8, 1947.

A. M. A. Section on Obstetrics and Gynecology. *Chairman,* Philip F. Williams, Philadelphia, Pa. *Secretary,* William Mengert, 2211 Oak Lawn Ave., Dallas, Tex. Annual meeting San Francisco, July 1-7, 1946.

New York Obstetrical Society. (1863) *President,* Harvey B. Matthews. *Secretary,* R. G. Douglas, 530 East 70th St., New York City. Second Tuesday, from October to May, Yale Club.

Obstetrical Society of Philadelphia. (1868) *President,* F. Sidney Dunn. *Secretary,* James P. Lewis, 1930 Chestnut St., Philadelphia, Pa. First Thursday, from October to May.

Chicago Gynecological Society. (1878) *President,* James E. Fitzgerald. *Secretary,* Herbert E. Schmitz, 25 East Washington Ave., Chicago, Ill., Third Friday, From October to June, Hotel Knickerbocker.

Brooklyn Gynecological Society. (1890) *President,* John J. Madden. *Secretary,* William T. Daily, 142 Joralemon St., Brooklyn, N. Y. First Friday, from October to May, Kings County Medical Society, 1313 Bedford Ave., Brooklyn, N. Y.

Baltimore Obstetrical and Gynecological Society. (1929) *President,* Lawrence Wharton. *Secretary-Treasurer,* John W. Haws, 9 E. Chase St., Baltimore, Md. Meets quarterly at Maryland Chirurgical Faculty Bldg.

Cincinnati Obstetrical Society. (1876) *President,* Carroll J. Fairo. *Secretary,* Joseph G. Crotty, 136 West McMillan St., Cincinnati, Ohio. Third Thursday of each month.

Louisville Obstetrical and Gynecological Society. *President,* Layman A. Gray. *Secretary,* E. P. Solomon, Hegburn Bldg., Louisville, Ky. Fourth Monday, from September to May, Brown Hotel.

Portland Society of Obstetrics and Gynecology. President, Charles Hunt. *Secretary-Treasurer,* Karl H. Martzloff, 808 Medical Dental Bldg., Portland, Ore. Last Wednesday of each month.

Pittsburgh Obstetrical and Gynecological Society. (1934) *President,* James S. Taylor. *Secretary,* Joseph A. Hepp, 121 University Place, Pittsburgh, Pa. First Monday of October, December, February, April, and June.

Obstetrical Society of Boston. (1861) *President,* George Van S. Smith. *Secretary,* Paul A. Younge, 101 Bay State Road, Boston, Mass. Third Tuesday, October to April, Harvard Club.

New England Obstetrical and Gynecological Society. (1929) *President,* Roy J. Hefferman, Brookline, Mass. *Secretary,* Fred J. Lynch, 475 Commonwealth Ave., Boston, Mass. Meetings held in May and December.

Pacific Coast Obstetrical and Gynecological Society. (1931) *President,* Goodrich C. Schauffer. *Secretary-Treasurer,* William Benbow Thompson, 6253 Hollywood Blvd., Los Angeles, Calif.

Washington Gynecological Society. (1933) *President,* James R. Costello. *Secretary,* Geo. J. Ellis, 1150 Connecticut Ave., N.W., Washington, D. C., Fourth Saturday, October to May.

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*Changes, omissions, and corrections should be addressed to the Editor of the JOURNAL. The number after the Society's name is the year of founding.

New Orleans Obstetrical and Gynecological Society. (1924) *President,* E. L. Zander. *Secretary,* R. A. Grasser, 2700 Napoleon Ave., New Orleans, La. Meetings held every other month.

St. Louis Gynecological Society. (1924) *President,* Otto Krebs. *Secretary,* John E. Hobbs, 630 S. Kingshighway, St. Louis, Mo. Meetings second Thursday, October, December, February, and April.

San Francisco Gynecological Society. (1929) *President,* Albert M. Vollmer. *Secretary,* Daniel G. Morton, University of California Hospital, San Francisco, Calif. Regular meetings held second Friday in month from October to April, University Club, San Francisco, or Claremont Country Club, Oakland, Calif.

Texas Association of Obstetricians and Gynecologists. (1930) *President,* T. F. Bunkley. *Secretary,* J. McIver, 714 Medical Arts Bldg., Dallas, Tex.

Michigan Society of Obstetricians and Gynecologists. (1924) (Formerly the Detroit Obstetrical and Gynecological Society.) *President,* Robert B. Kennedy. *Secretary,* Milo R. White, 2799 W. Grand Blvd., Detroit, Mich. Meetings first Tuesday of each month from October to May (inclusive).

Central New York Association of Obstetricians and Gynecologists. (1938) *President,* Edward C. Hughes. *Secretary,* Nathan N. Cohen, 713 E. Genesse St., Syracuse, N. Y. Meets second Tuesday of September, November, January, March, and May.

Alabama Association of Obstetricians and Gynecologists. *President,* Gilbert F. Douglas. *Secretary,* Hunter Brown, 1922 South Tenth Ave., Birmingham, Ala.

San Antonio Obstetric Society. *President,* I. T. Cutter. *Secretary,* S. Foster Moore, Jr., San Antonio, Tex. Meetings held first Tuesday of each month at Gunter Hotel.

Seattle Gynecological Society. (1941) *President,* Gerhard Ahnquist. *Secretary,* Roger E. Stewart, Stimson Bldg., Seattle, Wash. Meetings held on third Wednesday of each month.

Denver Obstetrical and Gynecological Society. (1942) *Secretary,* Emmett A. Mechler, 1612 Tremont St., Denver, Colo. Suspended during war.

Wisconsin Society of Obstetrics and Gynecology. (1940) *President,* Roland S. Cron. *Secretary,* Robert E. McDonald, 425 E. Wisconsin Ave., Milwaukee, Wis. Meetings held in May and October.

San Diego Gynecological Society. (1937) *President,* R. C. Hall. *Secretary,* D. Dalton Deeds, 2001 Fourth Ave., San Diego, Calif. Meetings held on the last Wednesday of each month.

North Dakota Society of Obstetrics and Gynecology. (1938) *President,* Ralph E. Leigh, Grand Forks. *Secretary,* G. Wilson Hunter, 807 Broadway, Fargo, N. D.

Virginia Obstetrical and Gynecological Society. (1936) *President,* A. L. Carson, Jr. *Secretary,* L. L. Schamburger, 628 State Office Bldg., Richmond, Va. Next meeting not announced.

Columbus Obstetrical and Gynecological Society. (1944) *President,* Wynne M. Silbernagel. *Secretary,* Zeph J. R. Hollenbeck, 9 Buttles Ave., Columbus, Ohio. Meetings held fourth Wednesday of each month.

Nassau Obstetrical Society. (1944) *President,* George B. Granger. *Secretary,* William S. C. Dolan, 2870 Northern Blvd., Manhasset, N. Y. Meetings, bimonthly from October to May.

Bronx Gynecological and Obstetrical Society. (1924) *President,* Harry Gordon. *Secretary-Treasurer,* J. Irving Kushner, 1840 Grand Concourse, New York, N. Y. Meetings, fourth Monday monthly from October to May.

Washington State Obstetrical Society. (1936) *President,* John H. Fiorino, Everett. *Secretary,* H. H. Skinner, Yakima. Meetings, first Saturday of April and October.

Kansas City Obstetrical and Gynecological Society. (1922) *President,* J. Milton Singleton. *Secretary,* Richard C. Helman. Meetings, third Thursdays, September, November, January, March, and May, University Club.

Los Angeles Obstetrical and Gynecological Society. (1914) *President,* George E. Judd. *Secretary,* Carl E. Krugmeier, 2200 West Third Street, Los Angeles, Calif.

North Carolina Obstetrical and Gynecological Society. (1932) *President,* Wallace B. Bradford. *Secretary,* Richard B. Dunn. Meetings semiannually.

The Society of Obstetricians and Gynecologists of Canada. (1944) *President,* William A. Scott. *Secretary,* James Goodwin, 516 Medical Arts Bldg., Toronto, 5. Meetings held annually, date of next meeting to be announced later.